



Synthetic Worlds

Nature, Art and the Chemical Industry

Esther Leslie

Synthetic Worlds



Synthetic Worlds

Nature, Art and the Chemical Industry

Esther Leslie

REAKTION BOOKS

Published by REAKTION BOOKS LTD
www.reaktionbooks.co.uk

First published 2005

Copyright © Esther Leslie 2005

All rights reserved

No part of this publication may be reproduced, stored in a retrieval system,
or transmitted, in any form or by any means, electronic, mechanical,
photocopying, recording or otherwise, without the prior permission
of the publishers.

Colour printed by Creative Print and Design Group,
Harmondsworth, Middlesex

Printed and bound in Great Britain
by Biddles Ltd, Kings Lynn

British Library Cataloguing in Publication Data
Leslie, Esther, 1964–

Synthetic worlds: nature, art and the chemical industry

1. Art and science 2. Chemical industry - Social aspects
3. Nature (Aesthetics)

I. Title

7-1'.05

ISBN 1 86189 248 9

Contents

introduction:

Glints, Facets and Essence 7

one

Substance and Philosophy, Coal and Poetry 25

two

Eyelike Blots and Synthetic Colour 48

three

Shimmer and Shine, Waste and Effort
in the Exchange Economy 79

four

Twinkle and Extra-terrestriality:
A Utopian Interlude 95

five

Class Struggle in Colour 118

six

Nazi Rainbows 167

seven

Abstraction and Extraction in the Third Reich 193

eight

After Germany: Pollutants, Aura and
Colours That Glow 218

conclusion:

Nature's Beautiful Corpse 248

References 254

Select Bibliography 270

Acknowledgements 274

Index 275

introduction

Glints, Facets and Essence

OPPOSITES AND ORIGINS

In Thomas Pynchon's novel *Gravity's Rainbow* a character remarks on an exploding missile whose approaching noise is heard only afterwards. The horror that the rocket induces is not just terror at its destructive power, but is a result of its reversal of the *natural* order of things. The world is upended by science. Such reversal is the general work of science as presented in Pynchon's paranoid vision of wartime, where 'ideas of the opposite' animate technological developments.¹ 'Ideas of the opposite' are as intrinsic to the science tracked in *Gravity's Rainbow* as they are to the science of the great chemical firms that were founded on the production of artificial dyes and later became central to the war effort of the Third Reich. Chemical reactions bring opposites together in an exchange of properties to produce new things. More specifically, the synthetic production of all the colours of the rainbow emerges from its opposite, the blackness of coal. This transformation of blackness into colour is part of another antithetical process: chemistry's efforts to turn waste matter into value. This pursuit aided a wider effort of inversion: the transformation of all nature into its artificial counterpart, as *natural* materials are remade *synthetically* in laboratories. All that exists and can exist is natural, but processes of deriving complex compounds from reactions produce substitutes, analogues, imitations and duplicates, which, because of the synthetic operations that bring them into being, seem to remain forever synthetic.

In *Gravity's Rainbow* Walter Rathenau, former German foreign minister and 'prophet and architect of the cartelized state', speaks from the grave during a séance to the assembled crowd of Nazis and an IG Farben director.² He speaks of two stuffs – the base materials of the Industrial Revolution – that he perceives as qualitative opposites of each other.

Consider coal and steel. There is a place where they meet. The interface between coal and steel is coal-tar. Imagine coal, down in the earth, dead black, no light, the very substance of death. Death ancient, prehistoric

species *we will never see again*. Growing older, blacker, deeper, in layers of perpetual night. Above ground, the steel rolls out fiery, bright. But to make steel, the coal-tars, darker and heavier, must be taken from the original coal. Earth's excrement, purged out for the ennoblement of shining steel. Passed over.³

Dark waste essence of coal was extracted in the process of making shiny steel. This remainder in turn could yield yet more unexpected transformations, such as the first synthetic dye, Perkin's mauve. Rathenau's description of activity in the depths of the earth is grandiose, but echoes of its terms can be read in many chemical histories, including those that served as sources for Pynchon.⁴ For the ghostly Rathenau coal-tar's significance is mystical:

A thousand different molecules waited in the preterite dung. This is the sign of revealing. Of unfolding. This is one meaning of mauve, the first new color on Earth, leaping to Earth's light from its grave miles and aeons below.⁵

Rathenau speaks from the realm of the dead, but he also speaks of death. These thousand different molecules will give from themselves in time a whole range of substitutions. What is revealed by these is the drive of the chemical industry towards 'the impersonation of life', 'from death to death transfigured'. Refuse turns into worth in an act worthy of alchemy, but rather than cracking the code of life itself, all that has been achieved, Rathenau cautions, is the polymerization of a few dead molecules. Rathenau, the son of the industrialist who founded AEG, warns that the IG Farben cartel grows as if it were an organic entity, but it is, in actuality, 'deep and dead'.⁶ Death imitates life and reinforces its dominion. It sprouts smokestacks that can survive the latest explosions. It is, or more specifically IG Farben is, a structure that favours death:

Death converted into more death. Perfecting its reign, just as the buried coal grows denser, and overlaid with more strata – epoch on top of epoch, city on top of ruined city. This is the sign of Death the impersonator.⁷

Coal, steel, coal-tar, artifice, synthesis, substitution, power, war, death – these elements bond to form chains of connection in the dark science of Pynchon's chemical cartel. Science is the referent, but magic is the black power invoked. Through coal's carbon chemistry, and its waste product of coal-tar, a realm of synthetic colours and substances is unlocked from a dense and primitive blackness. The first magic act is coal-tar becoming colour, the first of thousands of substitutions. This magic is a black force. *Gravity's Rainbow* lets loose its narrative strands amongst a world of acronyms and neologisms, fictional and actual. SPQR, ARF, MMPI, SOE, SPOG,

CIOS, BAFO, NTA, SHAEF, PWD, CNS, PISCES, VIAM, TSAGI, NISO, BAFO, OKW, ACHTUNG, Kryptosam, Hexeszüchtigung, ctenophile, Oneirine. These clatter like the evil spells from a necromancer's manual. These clotted words spell out the coordinates of military, economic and technological power. The most important of these cryptic formulae, the acronyms that generate the rainbow and allow the tracing of its arc, are the colour factory IG Farben and the German Second World War rocket weaponry known as V-1, V-2 or A4. Pynchon brings these two industrial-technological forces into proximity with magic, mysticism and alchemy. His perception has something in common with Adorno's and Horkheimer's assertion, written as bombs fell on Europe, that the process of enlightenment, its rationalization, its technological rationality, has a dialectical flip-side, that is to say, it is also its opposite. Enlightenment goes under the guise of science, but is, in fact, irrational, magical and trapped within myth.⁸ This magic that subtends but is repressed in industrial modernity converts, it seems, into a malignant force.

The opposites, substitutions, reversals that *Synthetic Worlds* traces are manifold and the themes accumulate as wilfully and refractedly as in *Gravity's Rainbow*. Here too chains of connection and flashes of conjunction are found between the colour wheels of eighteenth- and nineteenth-century dreamers such as Goethe and Philipp Otto Runge, the rainbow of synthetic colours and the arc of the V-2 rocket.

FROM COAL TO COLOUR

German chemical dexterity has a long history, from the pans and glass tubes of hobby scientists working with alchemical zeal onwards. The chemical act of producing synthetic colour is the first step in a modern alchemical practice of transmuting rubbish into gold. Just as the alchemist abets a marriage of opposites in the process of turning lead into gold, the chemist concentrates the oppositional and affirmative power of chemical reaction in the test-tube to produce the desired substance. Chemists at the turn of the nineteenth century sought substances such as synthetic colours in red and blue, cheaply coaxed metallic matter and gemstones, or industrially produced soda ash and guano. So began a war on physical reality, outbidding nature's own productions. Time's dominion was to be cracked too through the accelerating power of chemical reaction – modern magic consists in the short-circuiting of natural process, in speed-up, in the cheapening of materials and processes. In time, technology remakes time itself, removing it from natural rhythms to an abstract universal. On the insistence of the German Railway, on 1 April 1893, discrete spaces were netted into one through the introduction of Central European time. No longer were there local times oriented to the sun, with discrepancies across the Reich of up to 60 minutes. There was a single time and a realm of spaces that could be ever more swiftly traversed by new means of transport marshalling the powers of iron and steam. Space was rewoven, dis-

mantled and reconnected, and subjected to technologies. But where space – or the right space, the right land – was lacking, science could step in to compensate. Throughout the nineteenth century artificial treasures were chased, to supply burgeoning industries in a land, Germany, that was largely without colonies and lacking the necessary natural resources, except for coal. This book tells, then, for the main part, a very German story about the chemistry of substitution because substitution was German chemistry's leitmotif.

Its first fortunes rested on coal-tar dyes. German industrial chemistry concentrated on the production of analogues and replacements: aniline-based colours for alizarin and indigo; plastics and celluloid for ivory, horn and bone; rayon for silk; artificial fertilizer for guano; plastics and surface coatings for all manner of natural substances; synthetic oil and rubber. The development of each of the major German chemical factories follows a similar pattern. For example, the firm that came to be known as Hoechst AG was founded in 1863 (under the name 'Meister, Lucius & Co.') for the production of aniline dye. Its first product was a red magenta dye. Other colours followed. Products diversified in time, as Hoechst took on the production of chlorine, caustic soda and hydrogen in the 1920s. In 1925 the company became part of the chemical cartel IG Farbenindustrie AG. In the war years the conglomerate company fulfilled the demands of a war economy, serviced by forced labour, conscripted women and prisoners of war. The new fields of research and production included Buna synthetic rubber, methanol, synthetic fuel, light metal alloys and synthetic fibres. After the war and a period of American occupation, IG Farben's original component companies were re-established in 1951, and production concentrated on inorganic and organic chemicals, fertilizers, plastics, artificial fibres, colouring materials and pharmaceuticals. In the 1990s Hoechst shifted to life sciences.

A similar story is repeated at Badische Anilin- & Soda-Fabrik. BASF was founded in 1865 to produce coal-tar dyes. Its first products were aniline dyes, whose success was enmeshed with that of the textile industry. In 1871 the red dye alizarin was synthesized. Other synthetic pigments followed, of which indigo was the most important commercially. Production shifted away from colour stuffs to fertilizers in the early twentieth century, and in the 'stabilization years' BASF merged with Hoechst, Bayer and other companies to form IG Farben as part of a rationalization of the chemical industry. At this time production concentrated on synthetic rubber, fuels, operating agents and surface coatings, as well as advancing a sideline in recording technologies (notably magnetic tape for the Magnetophon recording device). After the war BASF concentrated on plastics. Between 1953 and 1959 plastics production in the Federal Republic of Germany more than tripled, and two of the best sellers were Perlon and Styropor. Once coal had been the basis of everything. Now oil – another carbon derivative – was the basis of these goods, and plastic would be its most significant form. From the mid-1960s BASF concentrated on surface coatings, and petro-chemicals.

Since its dazzling innovations in the nineteenth century, chemistry has granted new colours and surfaces, new substances, coatings and textures. Chemistry has invented simulants and surrogates for naturally occurring materials, often as compensation for the absence of natural resources in a world of carved-up territories and economic competition. These new replicant wonders emerged sometimes as the result of accidents or as by-products of pollution. At times these developments confounded earlier alchemical and Romantic philosophies of science and nature, but, at other times, dynamic and vital theories of chemical action combined with the emergent chemistry textbook orthodoxy. For example, the colour wheels of Goethe and Philipp Otto Runge, Hegelian ideas of spirit and Romantic ideas of the weddings of substances influenced the experiments that boosted the emergent German chemical industry of the 1830s. In turn, chemistry's inferences seeped back into philosophy, literature and art. This study tracks the confluence of technologies of industrial production, philosophies of science, politics and aesthetics from the onset of industrial capitalism. The story is anchored in German developments, but this is also a study of industrial capitalism more generally. Featured here are some episodes in the relationship between artists, writers, philosophers and chemists from the early nineteenth century to the turn of the millennium. Through these an enquiry is undertaken into what happens to art and aesthetics when products of the natural world are remade synthetically by chemists. For so long artists and writers were the ones who artificially remade the natural world – in painting, poetry and sculpture. Philosophers were the ones who interpreted the meanings and connections of the natural world. Once the science of synthesis – that is, the synthetic or artificial reproduction of things such as colour stuffs, or materials such as plastics, horn, ivory, pearls, diamonds and so on – is underway, what happens to artistic renditions of the natural world, and what happens to the philosophical account of nature when a new scientific language claims to have penetrated its secrets in profound ways?

For Marx and Engels processes of substitution, opposition, replacement and transformation amount to the very mechanism of industrial capitalist modernity. And so, for example, machinery transfers its value gradually to the products as it helps to form them. As it wears out it becomes a corpse that has retained its outer body but lost its usefulness. Value moves from one thing to another, in the process of an object's modification. This is a physical process and is traceable. Dyestuffs become the colour of a cloth, raw materials take on another form, coal dissipates into the air having produced energy. But in the course of capitalist production something chemically untraceable is also generated: exchange value. This is capital's most magical transformation – the invention of exchange value. A much-quoted line from *The Communist Manifesto* describes the impact of capitalism as a vaporization in which 'all that is solid melts into air'. A direct translation of the German original carries the same sentiment, if in less poetic form:

‘Everything fixed and standing vaporizes’. For Marx and Engels, this evaporation signals the possibility of facing the world ‘with sober senses’. It is a process of illumination. Old systems of production are overturned, old shibboleths shaken off as a new economic and social order comes into being. Marx and Engels champion this process, but recognize its inherent contradictions: its mystifications around the source and production of value, its disconnection and misvaluation of its parts (nature, workers, machinery). They, and others, as the embedding of capitalist industrialism advances, repeatedly survey a landscape that is frozen, frigid, where non-history occurs, a colourlessness that is the ‘grey on grey’ of non-progress, or progress’s reversal indeed, where people and events appear as shadows without bodies, as Marx puts it in *The Eighteenth Brumaire of Louis Bonaparte*.⁹

This book begins in the mines where the Romantics encountered the new sciences of geology, geogeny and geognosy, while dreaming up their ‘Open Sesame’ fairy-tales of mineral deposits and moral decay. It moves on to the first chemical experimenters who operated in the shadow of the Philosophy of Nature and Hegelian dialectics. Why did the chemical dream translate so well into reality in Germany? Perhaps because the dialectical bent of German philosophy mirrored the oppositional process of chemical reaction. Fantasy and mental movement germinated the wish for nature’s penetration, improvement and forsaking, the dialectics of chemistry conjured it into being. From here, the dialectics of nature suggested by Marx and Engels are invoked in the context of the critique of wage labour and value. Commodity fetishism is placed alongside the new technologies of image reproduction, as both are part of a world in which natural beauty and cosmic significance become easily reproducible, in factories and on photographic papers. In a new century, artists, in the guise of Vorticists, Futurists, Expressionists and Dadaists, react to this new world by generating an aesthetics of anti-nature and a valuing of the synthetic and composite. A militarist such as Ernst Jünger has his own curious response to this, delighting in the abuse of nature in warfare, and inventing a techno-sublime. All this takes place in the midst of revolutionary upheavals, emanating in part from the very factories where the world is being made anew in synthetic form. But artistic experimentation and class struggle in the colour factories are quickly dealt a terminating blow in the accession of the Nazis to power. At its narrowest this is a story of German chemical industry. More broadly it is a story about industrial capitalism. Assuming the perspective of Max Horkheimer, in 1939, as voiced in ‘The Jews and Europe’ – ‘He who does not wish to speak of capitalism should also be silent about fascism’ – this study addresses fascism as a type of capitalism.¹⁰ The Nazi quest to wage war and manipulate the conditions of life in the Third Reich gave further boosts to the project of chemical substitution and synthesis. One site of this work was IG Farben’s factory Monowitz at Auschwitz. Another – experimental, modernist, ‘degenerate’ – practice of examination of synthetic materials managed to take place

under the cover of industrial research. At the end of the war German industry suffered a temporary blow and so the focus turns to the Allies, to conclude the story of artists' writers' and philosophers' reception of chemical synthesis, the new doubled nature and the palate of artificial colours, prised through pollution, drugs and refrigeration.

FACETS: THIS BOOK COMPACTED

Tracked over this 200-year period is an increasingly calamitous entwining of natural and synthetic worlds. The opposition between humans and nature is a relationship frequently (and justifiably) conceived as abusive, especially in its mediations via technology. But some imaginations have conceived not an opposition but an identity between humans and nature, or at least a strong empathetic relationship. At certain points in the history of the development of human-nature interaction, the rape of a nature 'out there' cedes to empathy between humans and nature. At times, this vision appears Romantic or mystical, and it posits that nature external to us, as embodied in plants, rocks, the stars, is the possessor of subjectivity and agency. At other times, this takes the form of a scientific notion of humans as composed of the same matter as plants and rocks and stars. In both cases a world in unity is proposed as, at least, potential. There are moments, scientific moments, poetic moments, when humans are attributed a mineral consciousness. Such a consciousness was present in nineteenth-century Germany, when an arc was made between a subjective and romantically accented study of nature and significant technical and scientific discoveries. The Romantic perspective unfurled in relation to a philosophy of nature that presupposed dynamism, dialectic, animated nature and empathy between humans and nature, self, animals, plants and minerals. In such a cosmos, magical exchanges occur between humans and minerals, spirits and matter, poles and forces. In such a vision all is alive, historical, subject to change and movement. History is in nature, and nature is an animated unity. The operative terms are mimesis, reflection, and a collapse in distinctions between subject and object, in that an object is perceived not solely as an object but as a possessor of subjectivity. This was a poetic and philosophical vision, but it played its role in scientific investigation too. In contrast to the separation often declared between nature and technology, as well as between scientific thought and poetic thought, moments exist when their proximity or identity is to the fore. There are encounters between poets or artists and science or scientists – though in the case of the Romantics, poet and scientist could well be the same person.

Friedlieb Ferdinand Runge was a chemist attuned to the aesthetic side of chemistry. As chemist proper, he produced the first synthetic colour in 1833. As experimenter, his Romantically accented philosophy of nature and his Goethean morphological approach allowed him to generate glorious

patterns of swirling elements, aesthetic trinkets for chemical gazers, regarded by him as manifestation of the inner will of elements. The ability to think opposites at the same time and to embrace transformation was crucial to all his practices. His scientific practice was optimistic and democratic. His textbooks spread chemical knowledge to artisans and housewives. His chemical experiments, in attributing a will to elements, could be seen in a sense to be extending democracy to matter.

The industrialization of chemistry brought factories and large workforces, whose democratic enfranchisement was at issue. Marx and Engels focused on the question of matter as well as political representation. They subjected materialism to analysis and forwarded their own version in historical materialism. Historical materialism presents a specific way of regarding the relationship between humans and nature. It proposes that nature itself is historical. Through humanly deployed technologies, nature becomes historical, social, and so human in a sense. For Engels, too, the extraction and synthesis of alizarin up-ended the relationship between humans and the realm of nature, as ‘things-in-themselves’, unknowable entities of nature, became ‘things-for-us’, remakeable, remouldable, humanized.

Marx and Engels tracked the ways in which all parts of nature, including human beings, were exploited as a source of value in capitalism. This economic system raids everything for value, even the rubbish of industrial waste. Marx’s and Engels’s theory of the chemical industry’s early recycling led them to draw conclusions about the nature of the capitalist economy. From a materialist perspective (and one in which Engels, son of a textile manufacturer and sometime boss of a mill, was well informed), the issue of synthetic dyes, in particular, sheds further light on the development of the textile industry (motor of the Industrial Revolution), supplementing an economic study with an aesthetico-cultural scrutiny of the question of fashion, consumerism, and the manufacture of desirable goods.

Surrogate and synthetic industrial products resonate economically and politically. For Marx, gold, silver, pearls and diamonds featured in his attempt to establish his value theory and his proposals on commodity fetishism. What happens to value theory when wax, glass or mother-of-pearl can imitate the lustre of pearls? Or when, as in the nineteenth century, artificial pearls could be made by blowing hollow beads of glass, then filled with a mixture of liquid ammonia and white matter from the scales of fish, and pearl essence is produced from crushed herring scales. What is value, in the light of the development of simulants and the redeployment of rubbish? Aniline paints and dyes, for example, were first marketed as valuable because they were more ‘real’. This ‘real’ quality was based on the fact that they did not fade. Plastic likewise was marketed as a substance that was not degraded by history or nature. This raised questions about the impact of ‘artificiality’ and its relationship to the real. This, of course, had a longer history – for example, the imitation of gold by the skilled use of white and yellow pig-

ments came to be more valued than gold itself, in some contexts.¹¹ The age of synthetic substances gave the debates renewed vigour. Gold and coal make an interesting comparison, the bright and the dark, one a measure of authenticity and purity in its natural state, the other a means to synthesis.

Marx wrote about gold as the first universal element of exchange. He observed the way in which gold mattered for its function as money. Owing to its material properties and rarity, gold becomes a guarantor of value. Gold must be equal to itself, standard, reliable. Through its use as money, the natural matter of gold turns social. Its value is linked to the cost of its extraction. Gold becomes other than itself. A naturally occurring metal turns into money and money turns into a symbol, a promissory note, a paper token. A substitution has occurred.

Marx wrote of another substitution that defined the era of capitalist industrial production. Commodity fetishism is the process whereby the threads connecting the labour of one producer with that of the others do not appear as direct social relations between individuals engaged in working on and with inanimate objects. Each producer is transformed into a thing or object, selling labour power that services the machine and capital. In this process each producer relates to other producers not as subjects but as things, other objectified and competitive concentrations of labour power.¹² Commodity fetishism does not leave the manufactured commodities untouched. While the producer is denigrated to a mere appendage of the machine (instead of a source of value and energy), the things produced appear to adopt fantastic powers, the power to 'rise' and 'fall' on the market, the power to transform lives, the power to generate vast amounts of wealth. The simplest way of describing commodity fetishism would be to say that products appear for sale as if by magic. Marx specifies a particular magic innate to capitalism:

The whole mystery of commodities, all the magic and necromancy that surrounds the products of labour as long as they take the form of commodities, vanishes therefore, so soon as we come to other forms of production.¹³

And it is this magical quality that was visibly enstaged in new commercial arenas such as the arcades or the World Exhibitions, both of which precede department stores and today's shopping malls. The arcades were the first enstaging of the commodity object, made all the more glittery by the glass opened out onto the night sky, under a quivering gaslight. Glass, diamonds, mirrors, twinkly gems intensify and dramatize the light effects in the arcades. These shiny surfaces and baubles accompany the fetish commodity as it seals its magical victory. Later cellophane will embrace the commodity in a second shiny skin.

As the arcades fell into decay or were demolished to make way for broad boulevards, another technique of substitution came into being: photography.

The sun, the moon, the stars, nature's own trinkets fade into disappearance under the new city lights, but photographic papers capture their images for us, here on earth. Such domestication of the cosmic has its utopian face. Paul Scheerbart, for example, dreams of living in always-bright glass metropolises illuminated by electric lighting that outbids the stars and moon. Science is the means to realize a dream of a doubled world, which enhances nature, improves upon it, but does not destroy it. In actuality, the electric-lit metropolis of the scientific industrial age was as black as the coal that powered it. And chemistry, cherished by some as cosmopolitan and democratizing, issued in the project of national gain. German chemistry, especially its well-advanced chemistry of substitution, became the most powerful in the world and its research was hitched to military ambitions. Film and photography mediated the rape of nature in war. The chemical industry had it all covered: it produced the bombs and gases and the photographic materials. It was in the context of the First World War that the famous conglomeration of the chemical industry, IG Farben, was first mooted. Chemistry enmeshed in the fatal logic of war and competition. In part, chemistry did well out of war and the strong and centralized organization that war demanded suggested the trust form. But the lack of access to materials in war and the subsequent German defeat in 1918 obstructed the industry's progress, reinforced the need to combine into a cartel and motivated further quests for synthetic substitutes.

Scientific and technological developments resonated in art in a thematic sense, and also in a material sense in the new century. Now nature was reinvented in laboratories, art too founded new forms, embracing the metallic, shiny, industrial, synthetic and analytic. There was a certain predilection in some modernist practice for nasty colours, chemical colours. For the Vorticists and Dadaists advertising art, packaging, cheap synthetics, plastics, all the vulgar things, proposed new textures and substances. These novel art practices do not simply celebrate the new world. Berlin Dada in particular subjected the imperialist militarist order to critique, working on the image and the word to undermine the claims of bourgeois newspapers, the military and industry. These artistic developments took place against a background of class struggle and revolution, from which they could not be extricated. Franz Jung, Dadaist and revolutionary, exemplifies how art, aesthetics and politics intertwined and flowed on one from the other at this time. Jung's novel of 1923, *The Conquest of the Machines*, registers the ways in which new forms of energy and economy combine into a powerful force and how workers resist or fail to resist this. The year 1923 was a turning point: fascism emerged as a new galvanizing force amidst economic chaos. And, in 1925, IG Farben combined the major chemical forces, and the chemical industry found safety in numbers, while the workers' cry 'together we are strong' sounded increasingly hopeless.

As IG Farben formed, Siegfried Kracauer's feuilleton journalism reached its highest shriek. Kracauer charted an unfurling horror amidst the artificial-

silk-stockings glamour and typewriting workaday of the Weimar Republic. Kracauer is particularly interested in films and cinema, one the doubling of lives in dramatic fantasy form, a staging of the explicit encounter between audiences and the substitute world that has formed around them, and the other an architecture of light and illusion. Ernst Bloch coined a lexicon for the culture of the inter-war years. He wrote of an 'artificial middle', the space of ghostly white-collar workers at the missing heart of the everyday. In this 'hollow space' a middle rank of urban workers who imbibed a culture whose distractions, deceptions and promises allowed the sleepwalk to Nazism.

In the Third Reich nature functioned ideologically as epitomized in the phrase 'blood and soil'. The paeans to nature and anti-modern fulmination notwithstanding, synthetics research continued in the laboratories and factories of the new Germany. Because of their military importance, the most desired substances were synthetic oil and rubber. Chemistry was drawn into the ideological mesh, as popular science and company histories promoted the magical wonders of synthetic living. The Third Reich was a society founded on death – militarism, the soldierly ideal and the death camps. In a broader sense, though, death occurred in the loss of autonomy, as each self was expected to submit to the total bureaucratic power, and the proper form of model-citizen was the physically unachievable *Übermensch* more suited to marble statues. This was a society that embraced the synthetic substitutes. Here, in this empire, IG Farben embraced death, figuratively, in synthetic imitations of natural forms (some of which were designed to extend life), and actually, in the production of weaponry, some of which were made in slave-labour factories. As Pynchon put it, these were the structures that favoured death.¹⁴ And these structures were reinforced by the strong interlinkages between science, business, the military, political hierarchies and bureaucracy. In the v-2 the 1920s dream of flight to the moon and the discovery of other worlds reversed into its opposite, the reality of destruction of this one.

Chemistry outbid nature. Chemists were no longer at its mercy. The textbooks crowded over how chemists could determine the properties of molecules. Science was magic. There were other possible futures for science, ones that evoked the utopian sparkle of the Romantics and envisaged a unity of humans, nature and the cosmos. For example, there was a corner of the Third Reich where artists deemed degenerate found a place in a factory in order to carry out experimental studies of modulation and patina in nature and art and to investigate the properties of natural and synthetic lacquers, paints and dyes. These experimenters sought natural forces as a refuge, as a repository of values, but these values attempted to allow nature to speak in its own voice rather than articulating the commands of power. The experimenters were not exclusive, for all that nature could do, synthetic varnishes could do too, for the forces of nature worked through them also. Their work was inspired by the activities of two men called Runge, Philipp Otto Runge,

the Romantic, and Friedlieb Ferdinand Runge, the chemist. But the colour circles of the optical experimenters were overshadowed by the arc traced from the tail of the v-2 rocket.

The Nazis, just as much as their enemies, claimed to have reached the stars through their efforts. The stars were caught first on photographic paper and then brought down to earth, in the guise of the saviour Hitler and in Hollywood's charmers. Photographic equality, the possibility and right of all to be represented, became the over-representation of the charismatic types, that is, the dictator and the star, as Benjamin put it in his 1930s essay 'The Work of Art in the Age of Its Technical Reproducibility'. In chemical democracy and chemical fascism every social fact could be squeezed through a lens, chemically fixed, then slipped in the pocket or album, or projected everywhere and anywhere. But photography came to be used to advertise the fetish of the chosen few in an image culture of the dazzling, whose excessive luminescence blinded the onlookers. In a better world, subject and object would exist in a constitutive tension. The total penetration of an object by a subject was disastrous for both parties, according to Adorno in his post-war reflections *Negative Dialectics*.¹⁵ The object, that which exists outside the subject, needed to remain resistant to assimilation, to the smooth effecting of its own disappearance. It was the artist's task to bring the innateness of the objective material to voice. This expression of the artwork also allowed for the subject to be called into being. Its impenetrability gave the onlooker a surface to work on, to reflect on, and against which a response might be produced. In fascism, there was only the apparent total transparency of the media and the artwork, articulating the unambiguous message of power, just as it articulated for the recipient in its absolute absorption of the material, humanly natural and otherwise natural. The outcome was inhuman regression in every sphere. It was not just fascism that abused nature. Adorno's shriek against abuse was more pointedly directed at the us and its culture industry. Here were stars brought down to earth, only to live celluloid lives more beautiful, more compelling than those lived by non-stars in the flesh. Their twinkle, stolen from the cosmic stars, had turned nasty. In 1937, in Disney's animation short, *Mickey's Amateurs*, Donald Duck turns twinkle into a prelude for mass murder, in a desperate bid for stardom. Donald Duck enters Mickey Mouse's talent show. Because he wants to be a star, he sings 'Twinkle, Twinkle, Little Star'. But he keeps losing his place and has to start again, earning him a disapproving gong. On his third useless attempt to sing the song in his own peculiar style, he messes up again and gets dragged off stage by a large hook, while the audience laughs uncontrollably. But he comes back again (after a performance by Clara Cluck and Clarabelle Cow). This time he is armed. He tries once more to recite 'Twinkle Twinkle Little Star', and yet again the audience erupts into laughter. Donald Duck's response is to shoot two long rounds of machine gunfire into them. There is no carnage shown, but, even so, that scene was cut from the released

version. Did it reveal too graphically the violence inherent in the culture industry and its shooting stars, in this uncanny premonition of Sid Vicious's performance of 'My Way' in *The Great Rock and Roll Swindle* (1980), as he brings the song to a great climax by whipping out a pistol and pumping bullets into the bourgeois audience. But Sid Vicious, having finished with the bloodletting, tosses the gun to the floor, among the roses cast at him by the adoring fans, then gives the camera the finger and climbs the stairway to his doom. Donald Duck, after his murderous act, comes back, poking out of Goofy's hat, and manages, finally, to quack out a word-perfect recitation of 'Twinkle Twinkle Little Star', humphs a 'so there' smugly and then gets his neck caught in the cartoon's closing iris. As Adorno argued in his essay on the culture industry from the 1940s, 'Enlightenment as Mass Deception', Donald Duck must always be beaten and seen to be beaten.¹⁶ Nature and natural impulses are corralled, and the lesson is taught that life is about taking your punishment and humiliation and bowing down before the specially spotlit few.

The Nazis imagined that science, technology and manpower would enable them to win the war. And IG Farben imagined that the war might help them, the corporation, to win the post-war. The first post-war historian of IG Farben, Richard Sasuly, wrote of the company's construction of a massive bombproof aeroplane factory in a clearing of the Bavarian woods. Work was not begun until August 1944, as the German war effort crumbled. In April 1945, as the war ended, slave labour continued to construct the factory. Sasuly speculates on whether this was the madness of an organization in frenzy or an armaments plan for the post-war in which Germany and the West would turn on the East and destroy the Soviet Union.¹⁷ It did not happen that way, quite. But a new war began immediately and it was called the Cold War. IG Farben was split apart, put back into its constituent pieces, and, in part, seized by the allies. Correspondingly, this book's attention turns away from Germany in its final chapter. Europe was in ruins, its colour seeped away. This story ended in the context of a new geopolitical arrangement. Germany's chemical pre-eminence was rattled. Perhaps, in any case, the epoch of coal was well and truly over. Oil increasingly dominated in a new car-led post-war economy. America led the way here, with cars and the in-car meal, the burger, along with other synthetic foodstuffs,¹⁸ payable with money turned plastic. Technological boosterism at the New York World Fair of 1964 reanimated the utopian dream of space travel, while the former German rocket scientist Wernher von Braun helped to make it a reality. 'Better living through chemistry' was the optimistic post-war slogan. Dreams of eternal life were proposed. The Cold War dictated the official surface-look of continental relations. In a transposition worthy of poetics, the qualities of coldness transferred to the quackish boosters of the American way who promoted 'the freezer-centered society', a name for cryogenics, the artificial extension of life resumed after death.

But metaphors of coldness and environmental collapse were also the ones taken up in Europe by those who developed the most vicious critique of post-war politics and poetics. In France in the 1950s the Situationist critique appeared, characterizing the post-war consumer society as a glacial wasteland. Science could not save us, only the heat of revolution might make things move again. The Situationists insisted that the time that was stolen by being frozen into a rigid social arrangement – the waiting game of capital's utopia – must be repossessed by those who wished to live now. In England the poetry of J. H. Prynne appropriated the language of the new sciences from the 1960s onwards, scrambling it into new senses, and giving poetic voice to themes that would increasingly emerge in more directly political discourse: global warming, environmental poisoning and pollution, global trade, agribusiness. At the centre of Prynne's poetics is a body under attack from toxicity and subjected to science. Critical science fiction (represented here in the form of one short story by Pamela Zoline, but equally Philip K. Dick might have taken her place) provided a mass-market version of this encounter with the synthetic and the toxic. Theirs is a fluorescent world of screaming commodities. In the 1970s the critique, negation and appropriation of science turned mass-market in Punk. Punk embraced fluorescent colours, the colours of choice for the 1960s in commercial packaging and advertising. The Vorticist pink shriek of the magazine *Blast* from 1913 hit the high street in vinyl form, just as garish, offensive and hand-in-hand with vulgarity.

The closing and most recent encounter referenced is that of Iain Sinclair and the urban landscape. The metabolic rift between man and nature finds its apotheosis in Iain Sinclair's visioning of London from the perspective of a walker on a motorway, exposed to pollution, dwarfed by technology, subjected to noise and psychic distress. In the 1980s and afterwards Iain Sinclair developed a version of Romanticism in negative. He picked his way through municipal shards of rubbish, junk and corruption, seeking the effect of myths, urban and otherwise. The recurring shape in Sinclair's work is the Becton Alp, Romanticism's shadow, a dark industrial heap of coke waste, coated in artificial snow, designed to substitute for a mountain, in providing contemporary leisure activities.

In this final chapter all the previous themes collect, convulse and coruscate: the utopia of science, the deadliness of chemistry, the relationship between us and nature, the dreams of our mineral selves, the invention of new colours, the place and measure of value, the mutability of substance, chemical fragility and artistic technique, the poetics of the inorganic and pollution, the encounter of art and science, of critique and chemistry, money and matter and the legacy of the Romantics. Perhaps there are other ways of telling and finishing this history, other figures, other metaphors, other ways of figuring the encounters of art, nature, chemistry and industry. These were the ones that juttred out at me.

SOME WORDS ON METHOD

Walter Benjamin and Theodor Adorno steer this study. This look at the past sees double. Adorno and Benjamin, as much as Marx and Engels before them, are seen as part of an unfurling story of chemical-poetic encounters: they are characters, symptoms, manifestations of a wider history. But, at the same time, they guide the story: they are narrators, meta-figures, points of illuminating light in the dense darkness of the real. Both work dialectically, acknowledging real separations, while attempting to unite oppositions. Adorno and Benjamin offer ways of thinking at the same time – and in constellatory manner – art, science, technology, nature and their intermeshing through the epoch of industrial capitalism. In *Dialectic of Enlightenment*, Horkheimer and Adorno discuss art and science as the opposing poles of reason, both of which originated in magic's pre-modern unity, then fell asunder, leaving science to attempt to control nature through abstraction, while art pursues mimesis of the concrete. Science has a 'determined' relationship to nature, transforming its qualities into quantitative equivalents. At the same time, art respects relations that preserve nature's qualities through affinitive listening to its qualitative particularity. These alternatives at an impasse imprison us – the point is to break through them. In a world that managed the breakthrough, science would be reimbued with the cooperative magic that once inhabited both it and art. Science would not make the masses victims of its technology, but would service their specific needs. Influenced by Lukács's critique of the reifying effect of bourgeois science and knowledge, they sought an understanding that disputed the necessity of splitting of nature in two: dead mute nature and living humanity. In such a vision the mediators between the nature and humans are the tainted tools of technological injury, external to both, and which rape the earth and damage the worker. This is capital's actuality, but it is not therefore the only way of proceeding, and, as vision, it relies on a socially induced ideological fantasy. Adorno rights a misconception:

Just how false the vulgar antithesis of technology and nature is becomes obvious if we consider the fact that it is especially those facets of nature which have not seen the least bit of cultivation by human hand – alpine moraines and piles of rock debris for example – which look like nothing so much as those dumps of industrial waste from which the socially accepted need for aestheticised nature seeks to escape. Indeed, perhaps some day just how 'industrial' in appearance anorganic outer space really is will be shown. The still idyllic concept of nature, even in its telluric expansion, and subject to total technology, continues to be what it always was: a provincial insular notion. Technology is said to have 'ravished' nature – a turn of phrase that derives essentially from bourgeois sexual morality. In a framework of

different productive relations, the same technology might be able not to violate, but to help nature realize some of its aims right here on this old earth.¹⁹

Adorno observes that our restricted sense of picturesque and eternal nature is a fantasy, and an ideological one at that. From nature's point of view, there is no difference in appearance between its disordered piles of boulders and the waste generated by industry, product of historical action on nature. Industry and nature are not in opposition visually, and neither should they be so conceptually. That they are conceived so derives from repression. To keep nature pure, virginal, immune from history and development is an attitude that relates more to the inhibited relationships between men and women, in which women, like nature, are denied a voice and agency. Technology, if understood as the historical mediator between humans and nature, rather than the ever-present but ideologically obscured tool of work and profit, might, by making nature historical and recognized as such, allow nature, and us as a part of nature, to make history.

Both Benjamin and Adorno wrote in the context of a scientifically executed destruction in the Second World War. Benjamin looked backwards, casting his glance across the historical field that this book covers. He refused a pessimistic rendition of a negative scientific drive, devising instead a method whereby the utopian possibilities of the past were preserved, even in the darkest moments. Benjamin let utopia flash in the present. In 1921, in his doctorate on the concept of art criticism in Romanticism, and again in 1939, in his writings on Baudelaire, Benjamin quoted a line from Novalis: 'perceptibility is an attentiveness'. This, Benjamin noted in 1939, is a way of figuring aura, for aura overcomes the object-subject distinction by allowing objects to look back, endowing objects with the power to see:

'Perceptibility', as Novalis puts it, 'is an attentiveness'. The perceptibility he has in mind is none other than that of the aura. Experience of the aura thus arises from the fact that a response characteristic of human relationships is transposed to the relationship between humans and inanimate or natural objects. The person we look at, or who feels he is being looked at, looks at us in turn. To experience the aura of an object we look at means to invest it with the ability to look back at us.²⁰

Here is a utopian version of commodity fetishism. The animation of inanimate nature or things is not taken to be a sign of alienation but rather a sign of an empathy that is the wellspring of poetry, as asserted by the Romantics. There is an identity between the world and humans, a communication, a relationship, but not one of exploitation and abuse.

Adorno is less sanguine. He marks a space for utopia only negatively. Confronted by the worst of all possible worlds, Adorno grasps at the

slimmest chink of utopian hope, where might be found the possibility of a genuine exchange between humans and nature, mediated by non-oppressive technologies. 'The world is worse than hell, and it is better', he observes in *Negative Dialectics*.²¹ Hope is in cold storage, in art, which is but *Schein*, appearance, semblance, shine, the gleam of a surface, quarantined from life, and there it hides sometimes in unrecognizable form. Unrecognizable because, for example, nihilistic art, black and raging, holds the place for its opposite, a potential and longed for affirmation of everything. And this everything is all the colours of the rainbow.

Indelible in resistance against the fungible world of exchange is that of the eye, which does not want the colours of the world to be ruined. In shine (appearance) the shineless (non-appearance) promises itself.²²

The eye holds on to the hope to see beauty, colour, and that is why art both remains and encodes a resistance to the pale dullness of what is. Until a new world's dawning, there are only the efforts of theory – for, as Adorno states in *Negative Dialectics*, philosophy is a prism for capturing colours that cannot yet appear in their true light.

The indelible colour comes from the non-existent. Thought is its servant, a piece of existence extending – however negatively – to that which it is not. Only the utmost distance would be proximity; philosophy is the prism in which its colour is caught.²³

Philosophy is like coal in its natural state, before it has been worked on. It holds in and on to potential. We do not yet have the right tools to draw out its hues into our everyday lives.

The utopian and pessimistic approaches of Benjamin and Adorno resonate through *Synthetic Worlds* and steer the interpretations of historical events. Equally, the efforts to repair divisions – human, cosmic, disciplinary – through thought, through philosophies that think potential, while acknowledging the hurts of actuality, can be traced to them. Rifts are breached here, in segues that are more or less reasonable.

THE POETICS OF CARBON: BEGINNINGS

Wonders akin to the stuff of dreams – the alchemist's pursuit of gold made from lead – are realized by industry and chemistry on a grand scale. This book begins with the Romantic imagination conjuring up dreams of natural abundance that might be converted into wealth. In the gold-streaked and jewel-crammed mine of the fairy-tale a mineral poetics germinates. There in the mine this story of chemistry, synthesis and carbon's aesthetics begins. In the first chapter the mine is entered through the gates of Walter Benjamin's

imagination. It appears – or rather a miniature model of a mine appears – in his memories of childhood as an object of desire and promise. Benjamin's memoirs, written in the 1930s, are a backwards glance from the mid-point of industrial capitalism, written in the blackest years, imagining the wishes harboured by the dreamers of early industrialism. It takes a childlike eye such as Benjamin's, attuned to sorcery and labour, to reinvoké the fairy-tale's dream of untold riches and the immense powers of transformation released by magic and by industry. The Romantic fairy-tales of gems and riches existed in the same universe as the rising sciences of chemistry and geology, at a time when industrial interventions to recover coal began to change the landscape and to generate the energy to change it more. Coal is the power of the Industrial Revolution. Early experiments enabled the Industrial Revolution by extracting coal, and using coal-tar. The belly of the earth became a resource. What unfurls in their fairy-tales, as in the wider world, is a locking of nature into mechanisms of monetary exchange, a fatal dalliance with profit.

Carbon is found in its myriad forms in the mine – as coal, as diamond, as life. This primal matter stimulates the imagination of chemical utopians to produce realms of affinities, twinkle and beauty. Is it possible to tell a history – a history that has after all been told before from so many disciplinary perspectives – through aesthetic qualities, such as colour and blackness, light and dark, transparency and opacity, shine and twinkle? Is it possible to tell history from the standpoint of matter – coal, diamonds, gold, metals, glass, dyes, cellophane, ice and frost? Or, put another way, can those materials be articulated as historical entities – as transformative, transitory, non-eternal, productive? And can the workers on those materials come to voice? Through matter and materials, qualities and aspects, might something akin to experience be expressed, the separations between things, objects, subjects and disciplines plugged through attention to these different and differing perspectives? Experience shares a linguistic root with experiment, through the Latin, *experiri*, to try. This book encounters the many experiments in synthesis that produced the experiences of synthesis of the industrial epoch. It is about experiment and it is experimental in form. The miscellaneous themes glint off the larger theme of a poetics of carbon like light bouncing off the facets of a diamond.

one

Substance and Philosophy, Coal and Poetry

TO SPELL

There is a vignette in Walter Benjamin's 1930s memoir *Berlin Childhood around 1900* called 'At the Corner of Steglitzer and Genthiner'.¹ Benjamin conjures up a visit to an aunt. Each time he visited she would be wearing the same black bonnet and the same silk dress and she would welcome him from the same armchair placed in the same bay window. He imagines his Aunt Lehmann as one of many who never leave their homes, and yet, like fairies, they cast a spell across the street where they dwell, though they need never appear on it in person. Sorcery and the atmosphere of fairy-tales pervade this anecdote in Benjamin's memoir. He tells of a protective and affable old maidservant, a steep farmhouse staircase in a posh Berlin apartment and a little old woman mysteriously tucked in the nucleus of this domicile, hoarding knowledge and secrets and treasures. His aunt's apartment is to be found at the place where two streets meet, and so her magical powers seem to the child redoubled. The language of these streets exerts a charm on those attuned to spells. As a child, Benjamin transformed the name of Steglitzer Street, referring to a town in Germany, to *Stieglitz*, the word for goldfinch. Benjamin often mutated the words of his boyhood environment, and various anecdotes in his memoirs of childhood rely on this productive slipperiness of language. In mishearings, deliberate or otherwise, the child distorts language, eliding words, imbuing them with extra layers of meaning and imputing intentions in a way that makes language magical again, discovering the spell within worn-out words. The word is eroded through childish use, and so 'Markt-Halle' became 'Mark-Thalle', Muhme Rehlen, the old Aunt Rehlen of a children's rhyme, became the nonsensical *Mummerehlen*, little Benjamin's made-up name for a ghost. This linguistic corrosion is significant. In the market hall, under its new corrupted name, something other than business-as-usual happens: for the child, the market is the home of imaginative play and fantastic speculation, outside of the banality of buying and selling. And the invented spirit *Mummerehlen* taught Benjamin the value of disguising or wrapping himself – *sich mummen* – in words, losing and finding himself in them. This is poetics

for infants. In words' transformation, and in their transformability, lies their power. As such any word might be incantatory. Benjamin had long been convinced that the word – or its smallest unit, the letter – possessed a magical power. A footnote in his doctoral dissertation points out the Romantic connection between letters and magical powers. Schlegel wrote to Novalis: 'the letter [*Buchstab*] is the true magic wand [*Zauberstab*].'² Spelling and spell are brought back together again. Steglitz to Stieglitz, suburb to goldfinch, was an apt transformation in the cluttered parlour, for his aunt was like a talking bird in a cage, twittering on about relations in distant places and times. But while the bird-like aunt Lehmann might chirrup away in her corner, for the little boy there was always another game to distract his attention, to absorb his imaginative energies. It was a representation of a banal place of labour, and yet it seemed to concentrate magical properties.

Hardly had I entered, in fact, than she saw to it that someone set before me the large glass cube containing a complete working mine, in which miniature miners, stonecutters, and mine inspectors, with tiny wheelbarrows, hammers and lanterns, performed their movements precisely in time to clockwork. This toy – if one can call it that – dates from an era that did not yet begrudge even the child of a wealthy bourgeois household a view of workplaces and machines. And among them all the mine took precedence from time immemorial, for not only did it show the treasures which hard work wrested from it, but it also showed that gleam of silver in its veins which – as we can see from the work of Jean Paul, Novalis, Tieck and Werner – had dazzled the Biedermeier.³

This miniaturized wonder looks backward to an earlier epoch of accumulation and alludes to the proximity of labour and magic, when both are engaged in transformation: the transformation of work into wealth, of nature into value, of dark compactness into brilliant fiery beauty. Benjamin evokes the double-sidedness of the mine, as a site of industry and a spur to fantasy. As coal pit, the mine is the basis of all other industrial production, and as metals mine or minerals mine, it is a place where concentrated deposits could be wrung from an earth that gave up its riches only reluctantly. Sometimes, in return for its assets, the mine took life in notorious cave-ins and explosions. In a preparatory note for this vignette Benjamin jots down the line 'The mineworks of Falun on the dining room table. How, out of fear, I bent myself further and further over the table.'⁴ Falun was the site of a mine in Sweden, well known for its copper, extracted from iron pyrites, and for its gold, silver, lead, sulphur and green vitriol, interred in its many kilometres of talc and mica-lined tunnels, galleries and shafts. The mineworks at Falun were notorious for fateful cave-ins, which took on fantastical forms in literature and music.⁵ In the times between implosion and

explosion wealth was amassed at Falun as elsewhere through hard labour. In the darkest tunnels lay the brightest gemstones and metals. The mine is a lustrous place of twinkling jewels, glittering metals, of velvety black coal, as shiny as the swirling skirts of Benjamin's aunt. Such glistening and luxurious riches awaken desires and they promise sensuous pleasures. Many hearts have been lost to the mines and its treasures, its spirits and secrets. The mine is quarried for its imaginative potency also. The risks involved in excavation, the ever-present possibility of sudden collapses or lost paths, tender different futures, moments of the unknown, the chance of a path that is altogether different. The mine as a place where industry mingles with desire figures frequently in fairy-tales and in Romantic investigations – Benjamin mentions a number of figures associated with poetic representations of the mine, Jean Paul, Novalis, Ludwig Tieck and Friedrich Ludwig Zacharias Werner. For them, the mine is productive and seductive.

SORCERERS' APPRENTICES

The German Romantics dreamt a new world into being. They fantasized about a parallel world of easy natural abundance with riches, gemstones, diamonds, gold and silver trapped under the crust of Germany's earth and buried deep inside the mountains. This fantasy they shared in common with the popular folklore that they cherished and collated, and which the brothers Grimm garnered, often from the mouths of young women repeating the stories of their servants, governesses and nursemaids.⁶ The Grimm brothers' fairy-tale of *Simeliberg* is one vision of the riches to be accumulated effortlessly.⁷ Upon uttering the chant 'Semsi Mountain, Semsi Mountain, Open Yourself Up' the rock fractures and there appear mounds of gold and silver, pearls and gems heaped like corn. Through magic and without grafting, untold wealth can be acquired, though the risks are high and, sooner or later, death ensues. 'The Mountain Monk in the Harz', collated in the Grimm brothers' *Deutsche Sagen* (1816–18), tells the story of some miners whose lamp oil runs out. A giant ghost of the mine appears and gives them more. He helps them at their work, shovelling more in an hour than they can shovel in a week. His only command: they must never reveal what they have seen. Banging his fist against the side of the cave, a seam bursts open packed with gold and silver. There is more wealth there than they have ever mined through all their gruelling labours. This vision blinds the miners momentarily and they avert their gaze. When they turn to look once more at the gleaming riches, everything has disappeared. The cave has sealed itself once more. The vision was just a glimpse, now already only a memory. Had they but wedged a tool in the seam they could have kept it open and been rich forever. They had lost the treasure, but the ghost oil remained and never ran out. Something had been lost, but, as long as they kept this knowledge secret, they could at least continue to work on. One day, drunk in the tavern, they tell their friends the whole

story. From that day on, renormalized, they have to refill their lamps each morning. The secret centre of the earth, generous and bountiful and endlessly beautiful, and its guarding spirit should not have been betrayed. It was not to be made a matter of casual revelation. Industry opens up to fulfilment only to slam shut again, leaving just desire and recollection. The mine's precious contents mirror the mind's precious contents, desires and memories that fuel life, but may evaporate when exposed to the cold air of reason.

The Romantics and the tellers of fairy stories dreamt of riches and gems lost in another realm and only dangerously accessible. But by day some of them were more practically involved in mining and geology, and they sought ways to make the earth give up its treasures, even if these were not as twinkly as the imagined gems and stuff of stories. Several of the German Romantic poets knew well the technology of the mining industry. Clemens Brentano and Joseph von Eichendorff studied mining and geology, Germany's fashionable new science, in the early nineteenth century. They followed in the wake of Goethe, who had administrated the reopening of the ducal silver mines at Ilmenau in 1776 and familiarized himself with the technological aspects of mining in his 20-year service there, for he was keen to be not simply a bureaucrat. For poets, as for geologists, the technique was the same: to observe, closely, to experience and relate what was seen, to climb mountains and penetrate caves in pursuit of adventures in knowledge. The advice of Petrus Severinus, the Danish alchemist, was recommended to students of the earth and rocks. He counselled that stout shoes be bought, mountains climbed, valleys, deserts, seashores and deep recesses of the earth be searched. Minerals should be sought, their characters noted, their origins marked. Students of nature should buy coal, build furnaces, observe and experiment without ceasing, for in this way and in no other they will arrive at a knowledge of the nature and properties of things. Knowledge emerged from experience.

Knowledge of nature in all its parts was the quest, because only through a penetration of its secrets could progress occur. In 1799 Friedrich Justi Bertuch noted the importance of a knowledge of natural history for agriculture, manufacturing, trade, arts and crafts, state and private economy. But, for him, it is not yet that which it should and could be. Natural history, Bertuch contended, must not be the property of intellectuals alone. It had to be attuned to everyday life and understood by 'the unskilled, the bourgeois and the farmer', just as cultivation of corn and wheat, and use of compasses and ploughs, had been assimilated into the life of ordinary people. Natural history had to be 'popularized'. Bertuch lists the obstacles to popularization. One of the most important was the need for a rational classificatory system. The chemical language of nature had to find accord with a more rational language of chemistry. All the chemical textbooks and *orbis picti* only increased confusion. There was no agreement as to the language of natural history or the types of classification. German expressions were used for the kingdom of minerals, Latin expression for plants and a mix of languages,

including regional terms, described the kingdom of animals.⁸ Bertuch also bemoaned the lack of good images. All education in natural history must occur via the eye and not the understanding, he notes. An uneducated person has to perceive the characteristics either on the object or on a drawing of the object, so that 'the soul receives an imagetic impression of it'.⁹ Bertuch's effort at popularization includes sample images from the animal, plant and mineral kingdoms. Giraffes, camels, fruit, flowers and shells glimmer in hyper-detail. This was a time for naming, ordering and representing according to sensuous characteristics.

Abraham Gottlob Werner, who taught at the Freiberg mining academy for 40 years from 1775, sought a systematic knowledge of the nature and properties of things. Werner's most important contribution to geology was the classification of minerals. Through close observation he graded them according to various material properties, including opacity, colour, lustre, hardness, specific weight, chemical content, cleavage and crystal structure. Werner's work provided a nomenclature for the mineral world at a time when the new experimenters who engaged in the practical activity of chemistry insisted that all useful knowledge about the kingdom of minerals was chemical knowledge. Through chemistry the individual parts of nature could be made to speak about their history and their composition. Chemistry set about the task of discovering, naming and classifying organic substances. By 1800, 33 substances had been identified. More were soon to spring into life and be named. Werner did not only describe minerals. He also gave them a history. As well as close looking and naming, geology, or, as it was also called, geognosy, speculated on the origins of minerals and the earth. In this period some tried to ascertain, through physical observation, the probable age of the earth and the planets. The earth had a history. In 1778, in his *Époques de la nature*, Georges Louis Leclerc Buffon identified seven main epochs in the history of the earth: the formation of the solar system; the cooling of matter; the universal ocean; the subsidence of the ocean; the emergence of volcanoes; the arrival of animals; and the appearance of humans. The earth arose through catastrophe, but it did not appear suddenly and complete. It achieved existence and was shaped and reshaped over time. The earth marks its history on its contents, in its every stone and gem, on each mountain and seabed, in every plant and human being. But there were arguments as to what happened when the earth was formed. Werner was a Neptunist. Neptunists argued that minerals were formed as deposits from the ocean that had flooded the entire earth one million years ago. The waters gradually receded, but they had once been able to propel mountains and cut valleys. Rocks and stones on the earth's crust were sediments or precipitates from that great sea. Minerals and humans emerge from that sea, from waters that could be the waters of the Mosaic flood. Werner's account was opposed by other theories at the time. Vulcanism argued that heat and volcanic action were the crucial elements. A great fire that now rages in the volcanoes long ago heated and melted the earth, and it

is this that provided earth's current form. James Hutton, who led the Vulcanist school, argued that rocks are formed from the wasting of older rocks, which shed their debris under the sea where they are consolidated under great pressure and then disrupted by the elastic power of subterranean heat. As these spasms transpire, veins and masses of molten rock are injected into the crevices of disjointed strata. Once the new rocks are exposed to the atmosphere the process of decay sets in once more and the debris finds its way to the sea-bed again, where new eruptions churn up the waste matter once more. For Hutton the world was the output of a cycle without beginning and end.

Goethe's novel *Wilhelm Meisters Wanderjahre* (1828) sketches some of the recent theories of the origin of the earth and its parts. The hero attends a mining festival, where the mountains are a mysterious presence, and the guests excitedly discuss their shafts, their peaks and the metals of the region. Eventually a lively argument erupts on the formation and shaping of the earth. Some guests claim that the world emerged in its current form after the gradual recession of waters. Another supposes that the earth was shaped by fires that burnt up the surface and then retreated under the crust where it still rages in volcanoes and deep in the earth's belly. Its scorching lava formed the mountains. Others argue that the mountains burst out from the subterranean realms, driven by irresistible elastic forces. Still others insist that the mountains were deposited from the atmosphere above. Some guests contend that there was a great freeze, an ice age, and this scattered rocks into the plains, carried on glaciers far and wide. Once the thaw occurred these rocks sank deep into the ground. For all these various theories, the earth and all its contents come into being catastrophically under conditions of extreme heat or cold. Each introduces the question of historical time into the study of nature. As the earth embarked on a vast period of industrial transformation, attention had turned to its first great forging, to its origins.

THE POETRY OF COAL

Friedrich von Hardenberg was a geologist-poet. From 1798 he spent time with Werner as a geology student at a mining academy, the Bergakademie in Freiberg. He studied chemistry, physics, mathematics and medicine, mineralogy and mining. In 1800 he completed a geological inventory on bituminous carboniferous layers in central Germany.¹⁰ When he left the mining academy, he worked as an inspector of saltworks and mines until his premature death in 1801. His reports on the different extraction methods and processes of brown coal, which until then had been used only by chance as a fire material, nudged the German industrial revolution into being, although coal took a while to be established as a significant energy source in Germany. Peasants and agricultural workers preferred to take their fuel illegally and for free from fallen branches in the forest, as Marx's first political-

journalistic writings would note in an examination of the implications of the fact that the theft of wood was the most frequent crime in nineteenth-century Saxony.¹¹ Industry, too, was reluctant to change its source of energy. It continued to use wind and water mills, for there were no good channels of coal distribution. Later, once the railways were there, it would be so different, and coal would be the key to German chemistry, an artful science of substitution. Once coal was mined in quantity, it could be used to produce iron, and iron was needed to produce and transport coal. Coal and iron reinforce each other and propel industrialization. The tunnels are dug deeper and deeper. By then, in mid-nineteenth-century Germany, science meshed with industrial needs and much energy was expended on novel chemical wonders, fabricated in the new factories that sprang up alongside the rivers and in the forests, making anew the German landscape. This productive energy emerged only after a period of imagination and experiment, which involved some frenzied exchanges between poets and scientists. Scientists and poets alike shared ideas and they were productive for writing about the world and for speculating about its forms

By night the geology student and mine inspector Hardenberg went under his poet's name of Novalis. In his novellas and stories could be found images of the mine and miners. *Heinrich von Ofterdingen* of 1802 features an old miner who learnt his mining skills from a legendary miner called Werner, now his father-in-law, whom he sought out specially, in order to learn about 'his rare and mysterious art'.¹² The old miner cuts a strange figure in strange clothes and he tells strange stories and songs, one of which has words that are 'almost as obscure and incomprehensible as the music itself, which is exactly what made it so strangely attractive and entertaining, like a waking dream'. His strange labour takes him to the heart of the earth, where he seeks treasures as part of an arcane art, oriented by cryptic signs and languages. In *Heinrich von Ofterdingen* miners propose a mode of existing in the world, or relating to objects in the world. Miners possess a peculiar happiness and it is one that eludes the mechanisms of exchange. The miner values the twinkling gems and mineral deposits that he quarries for their aesthetic worth:

Poor is the miner born, and poor he departs again. He is satisfied with knowing where metallic riches are found, and with bringing them to light; but their dazzling glare has no power over his simple heart. Untouched by the perilous delirium, he is more pleased in examining their wonderful formation, and the peculiarity of their origin and primitive situation, than in calling himself their possessor. When changed into property, they no longer have any charm for him, and he prefers to seek them amid a thousand dangers and travails, in the fastnesses of the earth, rather than to follow their vocation in the world, or aspire after them on the earth's surface, with cunning and deceitful arts.¹³

Novalis notes the miner's financial poverty, but he insists that there are riches beyond the world of monetary exchange. The miner's relationship to matter is aesthetic and sensual. It is enough for him that he knows where the sparkly and glittery deposits lurk, and that he is able to draw them into the light. They fascinate him. Knowledge provides enough satisfaction, supplemented by the pleasures of observing and delighting in their shapes and patterns. Monetary value is immaterial, and even the deposits' use is not relevant. Instead, there exists an aesthetic value or a magical value, dependent on the gems' beauty and marvel. This is something that cannot be possessed, but only experienced. The old miner advises that a miner is similar to a poet, dedicated to beauty and distant from the chains of daily life. He works in darkness and in isolation. His aim is insight into the natural world and a respect for cosmic harmony. Metals and minerals are picked out as inherently socialistic. If their nature is abused, they turn against the abuser, dragging their opponent down in an act of revenge:

Nature will never be the possession of any single individual. In the form of property it becomes a terrible poison, which destroys rest, excites the ruinous desire of drawing everything within the breach of its possessor, and carries with it a train of wild passions and endless sorrows. Thus it undermines secretly the ground of the owner, buries him in the abyss which breaks beneath him, and so passes into the hands of another, thus gradually satisfying its tendency to belong to all.¹⁴

After the encounter with the miner, the poet-hero Heinrich is open to the world, as he contemplates one starry night. Divided nature is made one.

The moon hung in gentle radiance over the hills giving rise to wonderful dreams in all creatures. Itself looking like something dreamt by the sun, it lay turned in upon itself over the dream world and led a nature divided into countless parts back to that mythical age when every seed slumbered by itself and, lonely and intact, longed in vain to unfold the dark abundance of its incommensurable being. Heinrich's mind mirrored the fairy-tale of the evening. He felt as if the world were lying opened up within him showing all its treasures and concealed delights as if to a welcome guest. The great simple spectacle struck him as so comprehensible. Nature seemed to him to be incomprehensible only because it heaped such a mass of close and familiar things with such an extravagance of multifarious forms round people.

Heinrich has broken through to another type of vision, and this, of course, is at night, the time of ghouls and dreams. The Romantics pushed for a world beyond the world, a dark side of life, that opened to us only in

visionary moments. Novalis noted that 'It is only the weakness of our organs that prevents us from seeing ourselves in a fairy world'.¹⁵ The crystallographer and communist J. D. Bernal, more than a hundred years later, in 1929 would voice a similar sentiment, translated into more rational scientific terms:

We badly need a small sense organ for detecting wireless frequencies, eyes for infra-red, ultra-violet and x-rays, ears for supersonics, detectors of high and low temperatures, of electrical potential and current, and chemical organs of many kinds. We may perhaps be able to train a greater number of hot and cold and pain receiving nerves to take over these functions.¹⁶

The magic kingdom is there, but inaccessible to our normal senses. Goethe was convinced that the eye could be trained to see more, and this was the crux of it, for it was the eye that did the seeing just as much as the thing gave itself to being seen. The eye is active in perceiving the world. What it sees is fizzing with effects, for colour perception depends as much on the condition of the eye and the mind, as well as the moment and conditions of seeing, such as the ambient light, the distance from the object. Colour is not a stable given, but rather as likely to be present in reflected rays on the transparent skin of a bubble, the iridescent green-gold of an insect or the physiological and psychological colours caused by an overexposure to light or to another colour. The world appears to be seen and seeing greets the world. Our seeing may be enhanced.

THE PHILOSOPHY OF NATURE

Instead of inhibited senses, some imagine senses that are so fully developed that they become super-sensible, meeting and making a world that, in turn, meets and makes vision. Novalis phrases this meeting of world and organ in the following way: 'the star appears in the telescope and penetrates it'.¹⁷ That is to say, the star is active in demanding receipt by the organs of vision. Indeed so active is it, it becomes itself a vector of vision. Or as Novalis puts it, 'In all predicates in which we see the fossil, it sees us'.¹⁸ The star is assertive and sensible. The fossil looks back and participates in the intellectual act that makes its being visioned possible. For the Romantic philosophy of nature, all is imbued with thought, with philosophy – stars, fossils, humans, telescopes. For the Romantics, reflection is all, and all that exists must reflect. Like meets like, in the medium of reflection. Acts of thinking or seeing reflect on their own conditions of existence:

Thoughts are filled only by thoughts, only by functions of thinking, just as sights are filled only by functions of seeing and of light. The eye

sees nothing but eyes, the thought organ nothing but thought organs or the element pertaining to these.¹⁹

In the Romantic theory of knowledge super-reflection turns inward to think about itself.²⁰ Perception and knowledge become questions of self-perception and self-knowledge, available to everything in nature. Such self-knowledge is a pre-condition of being seen by others. Novalis asks: 'Do we perhaps see each body only insofar as it sees itself and insofar as we see ourselves?'²¹ As the site of an intense self-reflection, each object diffuses its self-knowledge outwards, so that its self-knowledge may be shared. There is a dizzying dashing back and forwards across fragmented parts of a mirroring whole.²² Such reflected knowledge is accessed through experiment and an 'observation' (*Beobachtung*) that is 'magical'. Knowledge is brought into being only when the object to be known knows itself. The knower is one pool of reflection and can access a thing's pool of reflection through empathetic observation. Observation has no questions to ask of nature, but rather observes the thing in its own self-knowledge, its own consciousness. Through 'magical observation', through the heightening of consciousness, the experimenter approaches the object and draws it into himself. Of this procedure Novalis notes that nature 'reveals itself all the more completely through him, the more his constitution is in harmony with it'. An experiment is 'the mere extension, division, diversification, augmentation of the object'.²³ Fichte identified the object to be known in his *Wissenschaftslehre* as 'something alive and active that from itself and by itself produces cognitions, something that the philosopher simply observes'. The experimenter 'gets the experiment going. But how the object expresses itself is the affair of the object'.²⁴ Fichte adopted the term experiment, a word that sits between experience, in the sense of feeling and suffering, and the procedures of science as it tests out the behaviour of nature. This type of scientific experiment does not assume a passive nature to be revealed by the thinking scientist, but rather evokes self-consciousness and self-knowledge, self-recognition in the things observed. Likewise, the human mind could only be understood through its relationship to organic and anorganic nature, of which it is both a part and which it reflects.

There is something aesthetic in this natural philosophical approach. That is to say, here, in this stance towards the knowledge of nature, the full sense of the meaning of aesthetics is present: aesthetic experience as sensuous experience, as a type of feeling. The Greek stem-word *aistheta* refers to that which can be perceived by the senses, the objects seen. This draws on the noun *aisthesis*, sensation or perception, and also evokes the verb form meaning to perceive, to sense or to feel. The aesthetic is that which is perceptible, presenting itself to sensory experience. The word retains traces too of 'aistheticos', the term used by Aristotle for the 'sensitive part', that which perceives. Aesthetic experience presupposes a body open to sense perception,

and it is such a body that can be the recipient of scientific knowledge of nature. Alexander Baumgarten, in his *Aesthetica* (part one 1750, part two 1758), developed such a notion of the aesthetic. Contradicting the rationalism of Descartes and the mechanistic science of Newton, Baumgarten insisted on the validity of knowledge produced by sensations and perceptions. Aesthetic value might be measured by the ability of a thing perceived to engender vivid experience in the viewer. The viewer is understood as a recipient of sense impressions.

The Romantic Philosophy of Nature perceived nature as a dynamic entity in flux. Within this nature, and unable to be disconnected from it, is the human being, incessantly communicating with nature through all organs of sensory perception and through the intuition of the mind. Mystical, magical forces course through this energetic nature, structuring all that exists and leaving decipherable marks, such that for some the interpretation of language and symbols is more important than mathematical calculation. These forces are general laws and they include polarities, syntheses and dynamic forces such as electricity, magnetism, heat and chemical affinity. The forces operate through nature at every level, from the kingdom of minerals to that of animals and humans. Polarity exists in acidity and alkalinity, north and south, plus and minus in electricity, oxidation and de-oxidation, coldness and warmth, and male and female. Polarity enables the thought of unity in contradiction, a nature that is one but animated.

Friedrich Wilhelm Joseph von Schelling was the most influential Romantic philosopher of nature. Schelling's *Ideas for a Philosophy of Nature* appeared in 1797, and the second edition in 1803. In this work, he described the whole construction of the universe in relation to forces such as attraction, expansion, passive and active cohesion, negative and positive polarities. The material universe is an infinite magnet. Schelling reconceived the mode of regarding nature, by recognizing in it the same rhythm as is in the ideal. Nature is the projection of spirit as objective mode. Schelling identified in nature, as in spirit, a movement of antagonism and reconciliation. For Schelling, the entire objective content of our knowledge is nature and the entire subjective content is the ego or intelligence. Not a split, rather these two poles are identical and it is impossible to consider one without being driven to the other. Philosophy perceives this only if it accepts that there is an absolute standpoint, above the oppositions (for if there are oppositions these must have been logically at one point unified), and from whose vantage point they can be seen as identical. In such a vision, thought, itself a force and only locatable within both subject and object, is at work. As Hegel explains in a lecture on Schelling:

The highest perfection of natural science would be the perfect spiritualization of all natural laws into laws of intuitive perception and thought. The phenomenal (the material element) must entirely disap-

pear, and laws (the formal element) alone remain. Hence it comes to pass that the more that which is in conformity with law breaks forth in nature itself, the more the outward covering disappears; the phenomena themselves become more spiritual, and finally cease altogether. The perfect theory of nature would be that by which the whole of nature should be resolved into an intelligence.²⁵

Through the highest reflection, which is human reason, nature returns to itself as known, for nature is identical to that which we call our intelligence or conscious mind. As such, the study of nature becomes the philosophy of nature. Such a philosophy of nature, which means essentially the tracing of the idea in nature, is speculative and more dependent on Kantian reason than laboratories. 'All quality of matter rests wholly and solely on the intensity of its basic forces [*Grundkräfte*]', notes Schelling.²⁶ And these basic forces are, as they were for Kant in the *Opus postumum* and the *Metaphysics of Nature*, as well as in *Universal Natural History and Theory of the Heavens*, attraction and repulsion. In the second edition of his philosophy of nature, of 1803, Schelling adds to these two forces *Schwerkraft*, gravity, the degree to which matter fills space. Gravity brings together attraction and repulsion. Schelling claimed that chemistry is nothing other than sensory dynamics. Where there is chemistry, there is sensation. In all of nature there is chemical activity, and so sensation too must be immanent universally. In this chemically dynamic vision, objects come into their own, engaging sensuously in the world through attraction, repulsion and intensive magnitude, just as we apprehend them through all our senses as well as intellectually. This affecting nature, in its ideal form or forces, is in accord with our intelligence. It pushes to be known. It reflects our intelligence back at us.

Such a wordy philosophy of nature has an experimental analogue, its physical assays on substances subjected to forces under controlled conditions. Many experimenters operated on the basis of its suppositions. Romantic poets, philosophers and researchers into nature's chemistry were bound together by dense networks of friendship and ideas.²⁷ The philosophy of nature was tested out in the efforts of practitioners. One such was Johann Wilhelm Ritter, an experimenter who was in Jena around 1800, when many in the Romantic circle were gathered there: Fichte, Feuerbach, Hegel, Hölderlin, the Schlegel brothers, Schelling, Novalis, Brentano, Tieck, Schiller and Goethe, for whom Ritter helped establish a scientific laboratory. Ritter's media were light and electricity. The natural philosophical idea of polarity preceded Ritter's investigations into light. Once F. W. Herschel had discovered infra-red radiation, beyond the red strip of the rainbow's spectrum, Ritter determined that there must be an equivalent, a polar counterpart of invisible light at the opposite end of the spectrum. This assumption came about speculatively, out of adherence to the polar conception. In 1801, beyond violet, he found ultra-violet radiation, or Chemical Rays. He exper-

imented with silver chloride, a chemical that is decomposed by light. Once decomposed the silver that is liberated turns the colourless substance black. (This science would later form the basis of chemical photography). Passing a beam of sunlight through a prism that splintered the beam into the colours of the rainbow, Ritter investigated the effects of each colour of light, observing the speed at which the chloride darkened. Deep violet broke down the substance faster. Light beyond violet, invisible to the eyes, acted most efficaciously, darkening the substance more rapidly. Ritter published his findings in a journal, under the title 'Chemical Polarity in Light'. Here he noted that sunlight, in its undivided state, neutralizes the two ultimate determinants of all chemical activity, oxygeneity and deoxygeneity (or hydrogeneity). The prism diverges these two determinants. Red is on the side of oxygeneity. Violet is on the side of deoxygeneity. The maxima of red and violet fall outside the visible spectrum but their indifferent point is found inside it, in the centre, in the region of green. Polarity was too fundamental an idea to be restricted to light. Ritter sought it in electricity, and set out a theory of electrochemistry, utilizing the attraction and repulsion of electrical charges to bond chemical elements. In 1800 Ritter initiated electroplating when he made metal attach itself to copper, and he found that the distance between the electrodes had an impact on the process. He experimented with Galvani's theory of electricity. One galvanic experiment involved attaching gold leaf to each end of two wires connected to a voltaic pile. The leaves attracted each other once brought into proximity, and once they touched, the electrical circuit closed. In 1800 Ritter 'galvanized' water into hydrogen and oxygen by electrolysis, and collected the two gases, one of which, hydrogen, he reasoned, collected at the negative electrode, the other, oxygen, transformed at the positive one. Ritter examined the effects of electric current on plant roots, seeking the relationship between electricity and growth. He used his own body, too, of course, as might be expected of a Romantic scientist. Ritter did not absent himself from the experiment. He investigated stimuli in muscles and electricity. He placed his own hands at the centre of the experiment, clutching negative and positive poles and observing how his muscles contracted when exposed to different stimulus amplitudes. He subjected his own sensory organs to the violence of electric shock, electricity coupling the body of the experimenter to nature. In a letter written to the philosopher Franz von Baader in January 1808, Ritter noted the 'overstimulation' to which he was exposed, and the importance of 'living' his studies, rather than merely knowing them.²⁸ Electricity bestowed 'animation on lifeless matter', as Dr Frankenstein demonstrated later with his monster in 1818.²⁹ But too much of something might flip into its opposite. Ritter died at the age of 33, in January 1810, his body tortured by experimentation, his finances ruined by the costs of his laboratory. 'Ritter is Ritter and we are mere squires', wrote Novalis to Caroline Schlegel in 1799, playing on the literal meaning of Ritter's name,³⁰ but also indicating in

what esteem the Romantics held him, and how he seemed of a different order than they. But it took those of a different order to penetrate the invisible, hidden side of things.

STARS AND SELF: THE NIGHT SIDE OF NATURAL SCIENCE

In Novalis's *Heinrich von Ofterdingen*, a party of travellers exploring a mine find hidden away in a dark cavern a hermit. He delivers a lecture on the importance of history. The hermit has devoted his life to contemplating the natural world, after a stint as a soldier. The hermit seems neither young nor old, 'and no traces of time were discoverable, except in his smooth silvery hair'.³¹ Another figure, the Count of Hohenzollern, adds that historians should be poets. Poets can relay better the curious connections between today's events and the past: the poet, confronted by a long-term series of events is able to detect 'the secret chain which binds the past to the future' and he learns to tear the fabric of history from hope and memory.³² History and memory, the past, present and future, all these in their various connections spring forth in the mine. The hermit passes Heinrich a book of pictures. Revealed now, in this deep space of the cave, is time. This is one more disclosure in a narrative where the earth is penetrated, veils are lifted, curtains are drawn and secret doors opened. Now a seemingly clandestine realm of the future, and of the links between then and now, is exposed. Time opens up inside the book that is inside the book. Heinrich sees images of the cave and the hermit, pictures of his parents and tutor, and scenes from his life that had been and scenes that were to come, for example, an embrace with a slender girl and a fight with thugs. As the picture book progresses the images turn dark and incomprehensible, and there is not yet a conclusion to its story. The past is there already, and it points into the future, but obscurely. In the mine, history comes into focus, but it is widely spanned. The hermit suggests turning away from the trivialities of the present, in order to encounter true history, by opening up the span of geological time. The hermit tells the old miner amongst the party that he and his mining brothers are 'well nigh inverted astrologers':

as they ceaselessly regard the sky, wandering through its immeasurable spaces, so do you turn your gaze to the earth, exploring its construction. Astrologers study the forces and influences of the stars, while you are discovering the forces of rocks and mountains and the manifold properties of earth and stone strata. To them the higher world is a book of futurity; to you the earth is a memorial of the primeval world.³³

Inside the cave, the past is revealed in the present, for the ancient action of water, heat, animal and plant decomposition has formed rock and coal

and gemstones. 'Inverted astrology' reveals truths about nature's past. Indeed geology was seen as a cipher language, a type of writing. Nature's writing compares with human writing, and the language of our world is reflected in the underworld, if subject to decoding. Novalis develops this quality in relation to secret languages and patterns that unite all aspects of nature, organic and anorganic, higher forms and lower forms, in the opening words of his *Die Lehrlinge zu Saïs* (1798):

Men travel by different paths. Who ever tracks and compares their ways will see wonderful figures arising; figures that seem to belong to the great Manuscript of Design which we descry everywhere, on wings of birds, on the shells of eggs, in clouds, in snow, in crystals, in rock formations, in frozen water within and upon mountains, in plants, in beasts, in men, in the light of day, in slabs of pitch and glass when they are jarred or struck, in filings around a magnet, and in the singular Coincidences of Chance. In these things we seem to catch an idea of the key, the grammar to this Manuscript, but this idea will not fix itself into any abiding conception, and seems as if it were unwilling to become in its turn the key to higher things.³⁴

Everything is shrouded in a coded language, and hieroglyphs may be found on organic nature as much as anorganic nature, on plants, animals and humans, in products of artifice and things of nature, scientific forces and acts of fate. Such thought relates to the medieval notion of God's signature in nature, sign of revelation, as argued by Paracelsus or Jakob Böhme, and it has an earlier precedent in the biblical notion that 'In the beginning was the Word'. For Novalis, all matter can be viewed through one prism, denying the normal divisions of sensory labour, with their methodological assumptions. Novalis jotted pages and pages of notes for his own fantastical encyclopaedia, to be called the *General Brouillon*, in which every branch of knowledge was to be brought into analogy, such that there might be spiritual physics, poetic physiology, physical history, chemical music, moral astronomy and more.

The cipher language of matter magnetized the Romantics. One who set out to decode it was Gotthilf Heinrich von Schubert. Having finished school in Weimar in 1799, his final exams taken under the headmaster Johann Gottfried Herder, he went to Jena to study with Schelling. Schubert practised as a physician, but ran into financial difficulties, solved by some stints at hack writing. He decided to return to academia and, upon hearing Werner's lectures on geognosy and mineralogy in Freiberg in 1805, turned his attentions to natural science. After this, encouraged by Heinrich von Kleist, Adam Müller and Karl August Böttiger, he lectured for a while to the educated laymen of Dresden, combining Schelling's philosophy of nature with his religious faith. Schubert's book titles indicate how revelatory and how practical his

researches were. In 1808 he published *New Studies on the Relationships of Magnitude and Eccentricities of Heavenly Bodies*. In 1812 he completed *On the Spirit and Essence of Things; or, Philosophical Glances at the Nature of Things and the Purpose of their Existence, Whereby the Person is Considered to be the Whole Solution to the Puzzle*. In 1813 he wrote a manual for Geognosy and Mining Science. In 1814 he wrote an influential study, *The Symbolism of Dreams*.³⁵ This asserted that in sleep and in the delirium that precedes sleep quite a different language is spoken by the soul. This 'dream language' is faster, more associative and the montaged fusing of images, where natural objects or characteristics of things can transfer to people or vice versa, are like 'hieroglyphs', combining a number of pictures into one. The temporality of this picture-language bears no relationship to the time of the wakeful. It is able to express in moments that which words take hours to say and we may experience several days' worth of action in one short slumber. This language is one of spirit, and is endlessly more expressive, more comprehensive and detached from usual time than normal word-language. It is a poetry possessed by all. It is innate and not learnt. It is the language of fate. It connects today's activities with yesterday's, the events of future years with the past, and betrays thereby a predictive power in its higher art of algebra. It is more succinct and more comfortable than our usual language, but only the hidden poet in our interior knows how to handle it. For Schubert we are doubled. Accompanying us is a *Doppelgänger* who inhabits another realm, and who manifests in dreams. We startle when we catch glimpses of our shadow-side in dreams.

This other language, these hieroglyphs visible in dreams, were found elsewhere in nature. Schubert sought a God-given meaning in the cosmos, traced in nature, in its anorganic elements, in living animals and humans and in the immaterial forces that govern them. All is inhabited by soul. Humans and animals possess similar souls, but humans are composed of three interconnected dimensions: body, soul and spirit. Soul and body are governed by or infused by spirit. Humans had not achieved their full potential. The human is still a 'prophetic hieroglyph', and invisible twine unites it with all humans living and those of the past and those of the future. Schubert's lectures dwelt on animal magnetism, clairvoyance, somnambulism and dreams. These phenomena emerged from what he termed the 'night side of nature'. Polarity manifested again – the day side, the night side, light and dark in nature.

Schubert's widely read study of 1808, *Ansichten von der Nachtseite der Naturwissenschaft* ('Views from the Night Side of Natural Science'), reported on a realm of nature that was not visible simply from or to our perspective.³⁶ He discussed contemporary natural science, but with an emphasis on those phenomena that eluded mechanistic, causal explanations. Old hieroglyphs full of earnest meanings gaze at us from the high pyramid of nature. Encounters with these old signs, if properly managed, can awaken a longing for understanding in the viewer. Once upon a time the viewer was closer to

understanding these hieroglyphs, and the meaning lay in the hieroglyphs themselves. But the visible day side obscured the night side, just as in the great flood *terra firma* became a vast ocean. Still it will be possible to bring the stony, half-effaced written characters back to life. Schubert wants to discover the origins of life on earth. For him the evidence points to the poles, for polarity is so crucial for this natural philosopher, and he imagines that a transition from anorganic to organic life occurred there, when it was lush, rather than in the Tropics.³⁷ A fall from Paradise is suggested. The world, he notes, is icier than before. Once the South Pole was green and alive with animals. Now the ice on the glaciers in the Alps is increasing and green meadows are turning to ice fields. Once all is gone from this world, Schubert is convinced that humans will remain on the lonely ruins, because love makes even the bare rocks beautiful and the human spirit adds a shimmer to all its vistas.³⁸ It is this human spirit with its shimmering glance on the world that discerns the night side at moments, and nature viewed from a darker angle reveals so much more than from the perspective of rationalistic science. Tales from the night side of natural science can show us how close indeed are all aspects of the cosmos. All is in unity. Everything is reflected in each other. The transition from the kingdom of minerals to that of plants and animals passes through metal, wrote Schubert, which is to say that we ourselves emerge of metal:

the whole kingdom of metals seems to have arisen at the boundaries of the two worlds, from the decline and deterioration of the anorganic, and to bear within itself the seeds of the new organic age.³⁹

The dark realm of nature is close to us and in some way is a memory of our own past as we emerged from mud. To bring it into the light of day will be possible again. Chapter seven in Schubert's book on the night side of nature looks into what he terms 'the so-called anorganic nature'. Here he argues that even the nature that seems most fixed and ineffective was once alive. He traces the continuum from anorganic nature to organic nature through analogies. Granite plays a particular role here. Granite is the symbol of magnetism and of contradiction (*Gegensatz*), and it is also a border phenomenon. Granite is an anorganic form that borders on the organic world, as can be seen in the tree-like column forms of its structure. This is even more apparent in crystal form. Quartz, formed from the cooling and solidification of granitic magma, is a crystal with six-sided columns and pyramids. It glimmers. Schubert notes that these characteristics cause it to look like a plant.⁴⁰ The forms of the upper world are reflected in the kingdom of metals. In another way, Hutton the vulcanist had seen in quartz the 'upper world', for he saw runes therein, which recorded the history of the world, while others saw Hebrew and Arabic characters.⁴¹ The most beautiful colours, from the purple red of garnet or the pink red of ruby or the beautiful green of the emerald, appear in the world of stones because of the mixing in of metals. There are

combustible things in metals and this proves their chemical relationship to the organic. The tree-like, leaf-like, woven, cell-like aspects, especially of pure metals, are similar to the higher organic world such that the eye can be deceived. Schubert was seeking the point of continuity from anorganic life to organic life. He chose metal, whereas later scientists would discover carbon, 'the organic element', as the link, relating us, then, rather more closely to diamond, carbon in its most concentrated form, to graphite, the crystalline form of carbon, and to coal, that complex of carbon, hydrogen, oxygen, nitrogen, sulphur and traces of virtually every element found in nature. Attraction to the twinkle of gems, the luminosity of colour, the infinite velvet abyss of coal is a type of recognition of an old soulmate, a long-lost relation: our eyes like diamonds, hair black as coal, our carbon selves interspersed fantastically with other mineral parts, our pearly teeth, our ruby lips. Magnetist thought suggested as much. In 1821 the chemist Friedlieb Ferdinand Runge wrote a treatise on 'The Genesis of Human Magnetism', wherein he wrote of a single force, a magnetic force, that inhabited all the materials of the universe:

If it is proven that humans evolved from animals, and that the animal is footed on plants, but the plant has minerals at its basis and these were born through the reciprocal influence of elements, so, then, the genetic development of human magnetism must have followed the same path. It cannot rest at animal magnetism, i.e., the reciprocal action between animal and animal, nor with the plant, i.e., the reciprocal action between plant and plant, nor with the mineral, i.e., the reciprocal action between mineral and mineral. Rather it must end and begin with the naked body of the planet itself, with the elements, earth, water and air and their reciprocal working upon each other, whether it starts up above (with humans) or down below (with the body of the planet).⁴²

This is a perverse evolutionism, with a vertical axis. We emerge of lower forms. It also has a horizontal plane. We are all made of the same stuff, the same elements. From planet to self, all is made of the same materials interacting. History is in nature, and nature is an animated unity.

These philosophies of nature argued that the forces of anorganic nature repeat themselves at a higher strength in organic nature, or that the same basic forces manifest in all nature. Magnetism, electricity and chemistry are the three potencies in nature. For the Romantics, there is a mirroring of upper and lower worlds, a reflection of one in the other, and a secret language of patterns that binds the two worlds. The romantically inclined geologists believed that the mineral world paralleled our own world. The contents of the earth were born of a tumultuous earth copulation, and since that time, at a slower pace than us, it too was striving to refine itself. Metals are combustible, suggesting a chemical affinity with organic matter, and their colours and shapes resemble forms in the upper world. Minerals and

metal reflect us, as they strive to inhabit the higher world, just as we strive to be closer to God. Such ideas of the principle of unity or single causes throughout the cosmos, though mystically phrased, anticipated the evolutionary science to come. Samuel Christoph Wagener wrote *The Life of the Globe and All Worlds, New Views and Conclusions from Facts* in 1828.⁴³ This primer dealt with the origin of the earth, heavenly bodies, comets and planets and catastrophes such as volcanoes and floods. One chapter is devoted to cities that crumble to dust because they have been built over craters. Wagener noted that nature's charm works on us the more we find our own selves in it, and so the book discovers analogies between human beings and the earth. The earth has a skin and an epidermis, a skeleton, a heart and senses; it respire and sleeps, sweats and bleeds. Like humans from tear ducts and orifices, the earth deposits and releases oily substances, such as minerals and coals. Wagener argued that all natural phenomena possessed one *Urkraft*, a force that pulls the stones to earth and sucks the juices of the earth into the trees, a force that effects chemical attractions, the army of comets and planets around the sun, gives rise to movement and animates intelligence, 'the great, invisible electric chain through which all works of nature are unified'.⁴⁴ This one primal force expressed itself as electricity in the anorganic world, oxygen in the organic world and 'in the brains of people it thinks'.⁴⁵

This was natural philosophy tinged with mysticism. Hegel had developed criticisms of such a view of nature perceived as 'unified organism', but, in effect, reduced, through an overly philosophical approach, to a few manifestations: polarity, circulation, layering. In his *Lectures on the History of Philosophy* (1805–17), Hegel criticized the Schelling school for its formalism, its reduction of everything to a series, 'a superficial determination without necessity', whereby a predetermined scheme is imposed on cosmic contents.⁴⁶ At its most extreme, this philosophy saw parallels and series everywhere, reducing everything to a series, and so, for example, in the organism reproduction is the manifestation of chemistry, irritability the manifestation of electricity, and sensibility is the workings of magnetism.⁴⁷ Philosophical method was lacking, and the philosophy it deployed, deriving only from 'intellectual intuition' and not logic, saw in everything the manifestation of a single principle. The 'potencies' of the absolute inhabited everything, and yet these, claimed Hegel, were but an external refitting of Kant's tripartite schema for the matter of the sciences, imposed at will. Natural philosophy, remarked Hegel, made the mistake of applying an external scheme to the sphere of nature, and this scheme derived from the imagination. At its worst this had led, in the silliest of Schelling's followers, to a meaningless play of analogical reflections, where, for example, a walnut was seen as a brain because of similarities of form, or wood fibres are described as the nerves and brain of the plant. All difference was lost in a facile paean to the absolute that smothered everything, and lost contact with the peculiarities of each sphere of reality.⁴⁸ Hegel insisted on the rigour of philosophical method in

penetrating the truths of capricious and disorderly nature, establishing its unification of thought and matter, whereby the Idea becomes imperfectly actual in nature (given nature's irrational contingency and liability to produce monsters).⁴⁹ To reach his own conclusions about nature and its spiritualization, Hegel considered the stimulations and evidence provided by the emergent natural sciences, tabulated and interrogated through the demands of spirit in his vast *Philosophy of Nature* (1817–30).⁵⁰

LIFE AND DEATH IN THE MINE

The most peculiar reality of all was the generation of life. From where did it emerge? Hegel embraced the idea, derived from Werner, that life generated itself spontaneously out of non-living matter millions of years ago. Hegel's *Philosophy of Nature* was characteristically dialectical on questions of geogeny. The Neptunist and Vulcanist debates were each equally one-sided, he thought, and both their principles had to be realized as essential.⁵¹ But, argued Hegel, Werner, at least, had a stronger sense of history than the Vulcanists. Hegel used Werner's geognosy, in his *Philosophy of Nature*. Geognosy introduced history into geology, and this, noted Hegel, was its most important contribution. Geognosy showed that the earth is a historical form, and that its state is the outcome of successive changes.

It is immediately apparent from the constitution of the Earth that it has had a *history*, and that its condition is a result of successive changes. It bears the marks of a series of prodigious revolutions, which belong to a remote past, and which probably also have a cosmic connection, for the position of the Earth with regard to the angle which its axis makes with its orbit could have been *changed*.⁵²

Rocks, even in their solidity and massive deadness, were historical forms. The particular qualities that they possessed were an outcome of the mode and time of their formation. Nature could no longer be considered an eternal realm. It is not exempt from the modulating rhythms and decisive episodes that structure and restructure the human world. Hegel's philosophy accentuated temporality, process, development and change. It sidled towards evolutionary theory.

Hegel's approach as much as the Natural Philosophers' pull into one plane, if at different rates, the unfurling of human history and natural history, human time and nature's time, an overlapping of one on the other. Time was well reputed to go awry in the mine, and such confusion was just that imbrication of human and natural time. A true story that seized the imagination of many was reported in the chapter on 'The Organic World' in Schubert's tales from the night side of natural science. In 1719, in the copper mines at Falun, at a depth of 130 metres, the perfectly preserved body

of a young man was found. In 1670 this young miner had died in the mine. His body, found between two shafts, had lain seeped in green vitriol for half a century. The body was soft at first and then, when brought to the surface, turned hard as stone, its features fixed as at the moment of death. Time goes awry in the cave. The corpse was placed, Snow White-like, under glass to protect it from the elements, but the efforts failed. It crumbled into dust, but not before a grey-haired old lady, passing on crutches, happened to recognize the still-youthful features of her fiancé. Schubert comments on the irony of the scene: one dead man raised from the grave, with the face of a youth, and one decrepit old body seized by youthful love.⁵³

Schubert's rendition of the story serves a scientific purpose: to establish a continuum from anorganic to organic matter, envisaged in the turning of the body to stone and back again by chemical action. The case is also evoked in order to show how difficult it is to know whether humans were on the earth at the time of the dinosaurs. The chapter discusses the finding of bones of large creatures who belong to another epoch of life on earth, before the Great Flood drowned organic life. In comparison to these bones, human bones decompose much more quickly, because of their higher phosphorus content. The human body can be mummified, but as soon as water or damp air reaches it, it crumbles.

E.T.A. Hoffmann published an elaborate version of the Falun story in 1819. Romantic concerns were interwoven in the tale. The man who is to die in the cave, Elis Fröbom, is encouraged to leave his life as a sailor by an old miner. The miner dismisses life on the sea as a life on the surface of the earth, where mere trade is carried out. The work of the miner, in contrast, penetrates to the heart of the earth, through genuine labour. Inside the earth, under the weak glimmer of light, the miner comes eventually to recognize the fantastical stone as the mirror reflection of that which is hidden above the clouds. Under the earth, the shafts of the mine are like passages in a 'magic-garden', with living stones, animated fossils, and dazzling gems and crystals. The old miner turns out to be in league with the 'secret power that governs in the lap of the earth and cooks up the metals'. He reprimands Elis Fröbom for being insufficiently wedded to the mines and too distracted by love on the earth's surface. Finally, the mine claims Elis Fröbom, as he throws himself into the deep shafts desirous of a 'cherry red glittering almandine', a deep red garnet of iron aluminium silicate, encased in clorite and mica (or *Glimmer*, as the Germans call it). This jewel is destined for his bride, the woman who will find his perfectly preserved vitriolated corpse once more some 50 years later. As it crumbles to dust, she, too, old crone, exhales her last breath.

Time is disrupted in the mine. The time of the cave is slow to the point of immobility, or perhaps the time of the cave is the slower time of extra-human life and development. This means that it is historical, a history of nature, outside human speeds and human history, and yet it is its cradle too. Such time confusion is also to be found in the first tale in the Grimm brothers' *Deutsche*

Sagen, 'The Three Miners of Kuttentberg', which tells of some industrious workers who each day earn their bread for their womenfolk and children honestly. One day they find themselves trapped in the mine with only a day's worth of provisions and a day's worth of lamp oil. They utter their prayers to the Lord, begging for salvation, and on they go with their work, for they do not like to be idle. And the bread never runs out and the oil lasts and lasts. Their beards grow long, though, subjectively, time does not seem to pass at all. Above ground, their wives assume that they are dead. After seven years of work, which feels no longer than a day, but for the growth of hair on their heads and faces, biology obeying human time, one of them cries that could he but see the light of day once then he would happily die. The second wishes that, could he sit just one more time with his wife for a meal, he too would happily die. The third requested a year of happiness with his wife and then death could do its work. Their only momentary yet most heartfelt desires uttered, the mine cracks open and each receives his wish, dying precisely at the moment requested. Gods and wish-granters are malicious, or too literal. There is malice at work, and human desire is always too immediate, too unstrategic. It is a secret language in the mines. Words adopt an incantatory meaning. Words turn to wishes, wishes are granted. This is no more or no less than the seemingly magical process of transformation occurring within nature at that super-slow pace, as organic matter transmutes itself, as vegetable matter turns to coal.

THE POETICS OF COAL

Coal was the crucial substance for making machinery turn its wheels and fire its pots and produce its gases. Made at the back of time and in the belly of the earth, this compact substance was hauled up to produce rapid change on the earth's surface. Philosophers speculated on the origins of the earth and all its contents. Natural philosophers turned natural historians probed and gazed and poked and fondled matter. Alchemists turned chemists and the world was not only to be known in all its parts: it might too be remade in theory and recast in laboratories. In the 1830s the most spectacular transformation occurred. Coal gave up the entire spectrum of colour, releasing the deposits of the past that had been locked in to its compact darkness. Colour glittered forth from blackness. It was a kind of magic. Dying and magic were long connected. In the days of natural dyes in Venice, a mystique attached itself to processes. Quite apart from the fact that dyers could not move to another town, for fear that they would betray secrets, in Venice dyers conspired to protect their knowledge of the details of the preparation of Venetian scarlet by spreading frightening tales. They spoke of a white ghost who spooked the dye works. They also mentioned a gloomy giant who wore a black mantle and a wide-brimmed hat, who haunted the dye works, lantern in hand.⁵⁴ The age of secrecy was ceding to an era of scientific societies, journals, patents,

encyclopaedias, treatises such as Antoine-Laurent Lavoisier's *Traité élémentaire de chimie, présenté dans un ordre nouveau et d'après les découvertes modernes*, published in Paris in the revolutionary year of 1789.⁵⁵ The magic of chemical transformation was codified. Now, though, coal reintroduced wonderment into chemistry. What it conjured forth was miscellany from non-appearance. Coal's apparent magic was in its ability to transform into its opposite. Coal is the sedimentation of everything, a concentration that might come poetically to seem like the very 'night of the world'⁵⁶ that replaces all that has disappeared – warmth and light and colour. Its antitheses are contained within it. As a book published by IG Farben on the history of organic chemistry, the chemistry of carbon and its compounds, expressed it in 1938: the shiny black of coal deposits had locked inside of them a previous world of life, and all its colours.⁵⁷ That composite deadness, black but multi-coloured, dead but once teeming with original life, could again release from itself life, for, as Goethe put it in *Faust*, 'Am farbigen Abglanz haben wir das Leben', 'Life exists in colourful reflections'. The transformation must seem alchemical, like rubbish into gold, decomposed matter becomes coal, and then, in addition, that waste's waste, coal-tar, becomes colour. Dark coal becomes the very stuff of organic chemistry, as well as industry. It is the bringing of waste back into circulation. Nothing is foreign to the system; rather, it is all a matter of how it recirculates. This was the future work of chemistry, the rising industrial science: to reproduce the world synthetically and from the cheapest stuffs. The chemist Friedlieb Ferdinand Runge made the first step into this region. From the tarry waste of Novalis's coal Runge painted a synthetic rainbow.

Eyelike Blots and Synthetic Colour

DR POISON'S SYNTHESSES

Wearing a black dress-suit and his best hat and with a cat clutched under his arm, Friedlieb Ferdinand Runge, or Dr Poison, as the Jena students called him, made his way to Goethe's house in October 1819. He had his poisons with him.¹ Born in 1794, he had been an apprentice in a pharmacy in Lübeck from 1810 until 1816, before undertaking the study of medicine in Berlin in 1818.² He moved to Jena, where he gained his medical doctorate, in May 1819, after work on the poisonous plant deadly nightshade. He took private lessons in analytical chemistry with Johann Wolfgang Döbereiner. Döbereiner, a 'Scheidekünstler', an artist of separation, so impressed Runge that he focused his studies on chemistry. Runge depicts one of Döbereiner's experiments, indicating something of the spectacular sorcery of chemistry. Döbereiner combined the lightest element, hydrogen gas, with the heaviest known one, platinum, and the result was fire, red-heat and flames. Runge found himself in the witches' kitchen. Poisonous plants fascinated Runge. One day he told Döbereiner that he had found a simple way to establish the presence of traces of poisonous plants in meals, drinks and corpses. Arsenic and mercury could now be traced and so poisoners had turned to plant poisons for murder. Runge proved that he could identify the presence of henbane, belladonna and thorn-apple in one of a number of bottles, by dropping the suspect solutions into a cat's eye. The cat's pupil dilated and remained wide open, even when turned to the sunlight. The poison paralysed the muscles of the iris. Döbereiner related the details of the experiment to his friend Goethe the following night, and Goethe summoned Runge for a demonstration. 'Ah, so here we have the future poisoners' nightmare', quipped Goethe. Runge raised his cat's head towards the light and 'with astonishment' Goethe saw the variance in the pupils. He enquired after the effects of plants other than henbane, belladonna and thorn-apple. Runge informed him that a doctor of his acquaintance, Dr Carl Heise, had found another plant that produced the opposite effect on the pupil. Goethe pressed Runge to experiment further, to see if this plant could be an antidote, and

wondered what would happen if both substances were introduced at the same time. Goethe asked Runge whence his interest in organic chemistry stemmed, and Runge related the story of how, in 1810, while working as an apprentice chemist in Lübeck, he had helped a young man to avoid military service in Russia by inducing faux-blindness. He knew of the effects of henbane in the eye because a few weeks previously, in the course of preparing a medicine, he had accidentally spattered the henbane solution in his own eye. His iris disappeared. The eye looked as if it were blind. His sight was weakened, but returned to normal after a few days. Impressed with the demonstration, Goethe gave Runge a tin of coffee beans on which to experiment. Runge's analysis of the beans discovered caffeine.

Runge intended to become a private tutor at the University of Berlin and so needed a philosophical doctorate. To this end, he investigated indigo and its combination with metal salts and metal oxide. He submitted this work together with two books that he had written on plant chemistry. These treatises were imbued with natural philosophical terminology. For Runge plant chemistry provided evidence of the continuity of chemical forms, such that 'phytochemistry is mineral chemistry repeated at a higher potency'.

Without mineral chemistry there would be no plant chemistry, just as without minerals there would be no plants – mineral chemistry is elevated to a higher being in the plant, and plant chemistry seeks to decipher this higher being.³

Runge describes the characteristics of sublation into a 'higher being'. Where minerals consist of mass and endurance, plants consist of energy and change, and so mineral chemistry considers that which is material and enduring, while plant chemistry looks at dynamic and changeable aspects. He produced schema whereby the human turns out to be minerals to the potency of four.⁴ His phytological writings considered the metamorphosis of plants, based on Goethe and Oken, but critical of their insufficiently dialectical conception, for these theorists saw only the progressive and not the regressive metamorphoses. Like the planet, Runge notes, plants travel an elliptical life course. Their existence is characterized by the positive and the negative, by development, progress and evolution, negated in reflux, regressions and revolution. Fruit is the revolution of the plant, for it makes itself an autonomous being. Fruit is the plant backwards, for it grows from the blossom not the root. The leaf is its beginning, the root its end.

Runge's viva voce took place in front of Hegel in 1822. Hegel closed the oral exam with questions about the formal aspects of scientific cognition in relation to Runge's phytological supplement. He criticized Runge's capacity to theorize properly in a philosophical manner.⁵ Despite these misgivings, Runge passed the exam, and was one of the first to habilitate in the natural sciences in the philosophical faculty of Berlin University. Prerequisite for

becoming a private tutor was the delivery of a lecture in German, which he presented in front of the faculty, including Hegel, on the mutual behaviour of colour and mass in plant stuffs. He had also to deliver a lecture in Latin, which he muddled through, throwing in clichés in a semblance of linguistic proficiency. After this, he spent a short period teaching technical and plant chemistry in Berlin and continued to research and write. He isolated quinine from china bark, and he examined soda and potassium carbonate in his first forays into anorganic chemistry. An essay in 1824 reflected on the harmony of animal life, and here he envisaged every organ as an animal in an animal, which grows with its mouth on the anus of another and uses its excretions as nourishment and produces excreta for another in similar fashion.⁶ Runge went to Paris to work in Dr Quesneville's laboratory. After this, he worked at Breslau University, and then in laboratories and factories, and became increasingly interested in aspects of industrial and social development: the textile industry and questions of urban hygiene. Sometimes chance suggested ways forward. In response to the cholera epidemic of the 1830s, Runge recommended the use of chlorine as a disinfectant, after chlorine gas had spread by accident in his laboratory. Runge's experimental science was spurred on by industrial need, but not constricted by it. It was an experimental science that had retained contact with philosophy, which also meant that it held onto traces of a pre-industrial, alchemical vision. It was also an experimental science that held onto the aesthetic, in its broadest original sense with *aisthesis* denoting knowledge of our sensations, that which speaks through and to the senses. His was an experimental science that was efficacious. Runge was credited with many scientific breakthroughs, including the synthetic manufacture of quinine, aniline dyes and guano, crucial for a land that was without significant colonial possessions and so without exploitable sources of natural materials.

In 1832 Runge took on the role of technical director at a chemical factory in Oranienburg, a state enterprise acquired in 1832 by the Prussian Royal Maritime Trade Society, for the state was purchasing a number of industrial works, textile mills and chemical factories in an effort to increase production through centralized control.⁷ Here Runge made his most significant discoveries. He was asked to investigate the properties of a vast quantity of readily available waste material. The waste material was coal-tar, an unpleasant remainder of the iron industry and coal-gas plants. In the iron industry coal-tar appears in the process of using coal to reduce iron from its ores in blast furnaces. In the gas industry it appeared through the use of bituminous coal to produce coke. Coal was a fantastic source of substances. Through coal's destructive distillation, four distinct and useful products emerge. Coke sits in the pot. Some gas is forced from the pot and captured, ready for distribution as illuminating gas. Some gas passes through a condenser and makes an aqueous solution of ammonium carbonate. Dividing itself from this solution is coal-tar. This remnant is a sticky, black, stinking stuff. Runge's factory

made ammonium chloride. For that it needed ammonia, which it extracted out of gas cleaning water from the Berlin gas factories. This arrived in old oil and tar containers, which sometimes contained more coal-tar than ammonia, stuck to its sides.⁸ Someone at the factory decided that even if Runge could only mitigate the stench of this waste matter, progress would have been made. Only one other person was working on this plentiful material, Karl Freiherr von Reichenbach. Reichenbach discovered various by-products of tar, such as paraffin in 1830, naphthalin in 1831 and creosote in wood tar in 1832.⁹ Runge suspected that coal-tar might yet give up more wonders. In 1833, through a high-temperature dry distillation of coal-tar, Runge made a volatile liquid. He further distilled the liquid with steam. The result was a light oil and a gummy deep brown residue. This he shook together with aqueous calcium chloride, in an effort to rid it of its dreadful smell. As a result, chlorine gas was emitted and the smell remained. Chlorine on materials of vegetable or animal origin destroys colour or bleaches it, but during this experiment he found that chlorine could work in an opposite fashion.¹⁰ The colourless calcium chloride solution, he saw, had taken on a deep blue colour once it settled. This indicated the presence of a new and unknown substance, which he isolated and investigated further. Runge named this blue cyanol, blue oil. It was the first synthetic blue.¹¹

Synthetic blue had arrived. Blue would always have a special meaning in dye, for blue was the colour of sky and so of heaven, and as such the most sought after. Later, in 1843, August Hofmann would recognize cyanol as the same substance that Otto Unverdorben had isolated from indigo in 1826 and named *krystallin*, and C. J. Fritzsche named *aniline* in 1841, after he treated indigo with caustic potash and found that it yielded an oily substance, which he named after *indigofera anil*, one of the indigo-yielding plants. Blue was only one arc in the new synthetic rainbow. Now that the code had been cracked Runge found that cyanol could be transformed into other colours by the addition of different substances. Cyanol was quite colourless in itself and it made a yellow stain on pine, but did not colour other woods or fabrics. Once the oil is removed, the colourless watery solution turns dark red and forms a dark red crystalline precipitate. This was usable as a dye. He also made an acid, phenol, from the mother lye. When cyanol came into contact with oxidizing agents, such as chlorine, nitric acid, chromic acid or copper chloride, it created hues of blue, violet, black and red. Nasty black waste matter could release from its darkness a world of colour, but Ernst Eduard Cochius, the director of the factory, refused to take up the discovery, since he thought it too risky. No commercial contracts were secured. In any case, Runge was not favoured at the factory, for he advised other firms and was regarded as disloyal. In the 1840s a fire at the factory destroyed his accommodation and he received no recompense. The factory also refused to give him a permanent contract, and ignored many of his suggestions.¹²

Runge was a popularizer of science. He put his energies into writing textbooks, for, as the century advanced, the industrialization of labour techniques advanced, and manuals to guide workers and students through the technical present were required. Several teaching laboratories had been established, such as Liebig's in Giessen (1828), Wöhler's in Göttingen (1830s) and Bunsen's in Marburg (1840). Chemistry was the science that had most relevance for the new modes of production and it also carried much of the hope for future material well-being. The *Leipziger Illustrierte Zeitung* wrote in May 1844:

The effects of chemistry . . . are so splendid and irrefutable, that it is only rarely denied recognition of its value . . . and every educated person increasingly feels the need to attain for himself at least some familiarity with its laws and manifestations.¹³

Runge wrote for 'Everyone', and in 1839 translated the thirteenth edition of an English chemistry book by Mistress Jane Marcet, *Conversations on Chemistry, in which the elements of that science are familiarly explained and illustrated by experiments* (1806). Here, in the form of salon conversations between Mrs B and two curious young girls, themes in chemistry are introduced. The chemistry of everyday life interested Runge, and he knew intimately the chemistry of nutrition, detergents, colours, bleaching agents, heating and lighting. Orphaned at the age of 17 and a bachelor all his life, he was quite at home in the kitchen and happy to do the housework. Robert Wilhelm Bunsen met Runge and wrote of his encounter in 1832.

He is a highly original man. I found him lying on a sofa, with hair in long curls hanging down to his shoulders, in the style of a cobbler's mate, and, with one hand he was filtering a precipitation, while the other was stirring a few potatoes, which were boiling over a chemical lamp.¹⁴

He wrote his own domestically oriented book in 1866, a series of letters for housewives. Runge's writings also targeted certain groups: physicians, pharmacists, farmers, manufacturers and craftsmen in 1830, dyers and printers in 1834, roofers in 1837, school children in 1846. Runge's popular pedagogy had a precedent. Little manuals of chemical skills had long existed in German. Books had advised on cooking, bleaching, fermentation, washing and so on for more than 200 years. Books written in the vernacular for the use of the common folk had long been part of the household. In 1531 there was a book called *Rechter Gebrauch d'Alchimei* (The Right Use of Alchemy), which dealt with the preparation of metallic alloys, the tempering of steel, engraving on metal with acids and the preparation of inks. In 1532 appeared *Allerley Matkel und Flecken auss Gewant, Sammath Seyden*,

Göldinen stücken, Kleydern, etc zubringen (To Remove Any Kind of Stain or Dirt from Cloth, Velvet or Silk, or Cloth of Gold, from Clothing, etc.). A handbook for stain removal, it also contained ideas for dyeing and simulating materials. But Runge's contribution to this field coincided with a renewed scientific confidence. Runge was meeting an obligation for every person to gain a familiarity with the workings of nature. Gustav Bischof, a professor of geology, noted that it was a bourgeois duty to instruct those who are unfamiliar with nature. Bischof's own *Populäre Briefe an eine gebildete Dame über die gesammten Gebiete der Naturwissenschaften* of 1848 (Popular Letters to an Educated Lady on all the Areas of Natural Science) is motivated by a desire to disseminate natural scientific knowledge amongst those who are not professionally involved. It was certainly the case that women received little scientific education at school. Letters on scientific matters to an educated lady would enable her to manage better her household. But understanding nature possessed political significance at Bischof's particular moment of writing. Bischof's preface, written in March 1848, indicates the tumultuous worldwide revolutionary events of 1848, 'an extraordinarily animated time', when in days or even hours political events transformed, and 'excited minds long for a place of rest'. It may be that in such days as these the 'quieter, more restful forces in nature are in the position of affording such a resting place'. But nature is not simply a refuge. It is also a guarantor. Bischof notes that in politics as in nature the password is progress. Rocks weather and collapse into dust and earth; organic life invades the remnants; and the bleak, dead, anorganic kingdom is overcome by lively organicism. Life always asserts itself, and progress is assured, because 'a higher force leads it'.¹⁵

Runge's contributions are carefully constructed manuals. He included pieces of coloured or coated paper or cloth, tipped in by hand, in order to ensure that the chemicals, colours and effects were properly visible. The results of experiments are not represented but rather supplied as actualities. The textbook writings reveal the underlying philosophy that propelled his researches. The preface to his *Introduction to Technical Chemistry, For Everyone* of 1836 contains an attack on the 'regiment of schoolmasters', who teach pupils as if they were to become schoolmasters like them. In his preface to *Basic Lessons in Chemistry for Everyone* of 1843, Runge justifies his procedure of withholding information, and of pushing people to undertake the experiment themselves 'because through seeing and touching one learns much better than by script and word'.¹⁶ Indeed later, in 1866, his book *Letters on Household Economics* described all sorts of experiments that could be, or indeed were daily, carried out in an ordinary kitchen. Chemistry is a sensory art. Runge's perspective was one derived from a sensitivity to the totality of the object of study and the inter-relation of its parts. His work is essentially synthetic, rather than analytical, that is, it is about synthesizing, putting things in combination and observing how they react. The first chapter of his

Introduction to Technical Chemistry, For Everyone, on the ‘Concept and Scope of Chemistry’, notes that chemistry is the science of the component parts of our earth: ‘Stoffe’, elements, found in minerals, plants, animals and people, in combination. Fifty-four elements had been identified. Each element is distinguished by its behaviour in reaction with another. Two elements form a third. Runge notes, in a language reminiscent of the language of polarity:

Characteristics that disappear in reciprocal action must be opposed ones. Chemical combination presupposes that there are *opposed* characteristics in the elements, by dint of which such an inner penetration occurs that the result is the levelling out of the oppositions.¹⁷

For Runge, all elements in an experiment come to expression. He notes that the fibre that is to be dyed is not just a ‘mechanical vehicle’ to which the colour simply adheres. It is rather an essential component, and that is why cotton, linen, silk and wool react so differently to dyestuffs.¹⁸ In an analysis of the properties of gold in *Basic Lessons in Chemistry for Everyone* Runge notes that gold is the most ductile metal, for a single grain can be drawn out to a 50-foot strand of wire.

This proves that the little pieces of gold hold onto each other more tightly than those of any other metal and so it is all the more remarkable that separated little pieces of gold, e.g., gold filings, do not seek each other out with that very force and strive to unite, even when circumstances are favourable. That is to say, if gold filings are heated in a dish, all of the parts do not unify themselves into one mass. Even once they are completely liquid, several little parts remain as single, separated drops.¹⁹

Runge’s materials are animated. They act wilfully, it would seem. Chemicals combine or unite. They marry and split. Runge’s scientific language is one of affinity and repulsion. In his text of 1834, *Colour Chemistry, Founded on the Chemical Relations of Cotton Thread to Salts and Acids*, he notes, for example, the affinity of cotton for different dye substances. These characteristics – such as the instability of cochineal red – form a sort of personality. In the opening pages of *Basic Outline of Chemistry* of 1848, Runge notes that there are now 59 elements in the world. Each of these has its own characteristics and displays a specific behaviour: ‘The chemical behaviour of an element depends on its chemical activity, and this activity is its peculiar expression of life when confronted by another element.’²⁰

Basic Lessons in Chemistry for Everyone included a quotation from the Apocryphal / Deuterocanonical Book of Wisdom, ‘But thou hast ordered all things in measure and number and weight’. The reference was biblical, but the intention was scientific. Runge was an inheritor of the world after Antoine-Laurent Lavoisier, the tax collector and hobby scientist who was

executed as an enemy of the French revolutionary state in the year of Runge's birth. Lavoisier's teachings transformed chemistry through his careful work with measurement. Lavoisier's attentive measurements showed, contrary to long-held scientific opinion, that pure water could not transmute into earth, but rather that the sediment collected from boiling water stemmed from the wearing away of the boiling vessel. Lavoisier burnt phosphorus and sulphur in air, and measurement showed that the products of this were heavier than the originals. The air, of course, had lost in weight. In this way, Lavoisier established the Law of Conservation of Mass. In another experiment Lavoisier measured the weights of rusted metals in a sealed container. They had gained in weight, having drawn oxygen from the air and combined it with the metal. Lavoisier gave a name to the element oxygen and thereby banished the phlogiston theory, which argued that there was an element that produced fire. Measurement was crucial to chemistry, but in his own description of the essential qualities of chemistry, Runge concentrated on process, from the chemicals' point of view, rather than procedure, as seen by the chemist. Notions of opposition and unity come to the fore.

Chemistry is the doctrine of *reciprocal action* of elements, which, on the one hand reveals itself as *attraction* and *combination* and, on the other hand, as *repulsion* and *separation*. The bearers of this reciprocal action are two sets of elements, differentiated by the name: acids and alkali. Both these sets of elements confront each other as oppositions, i.e., as of quite different types. Characteristics that are missing in one set are present in the other, and those which are lacking in this one are present in the other, so that in fact they present chemical *halves* whose activity manifests itself as the striving to appropriate the lacking half and so to become a chemical whole.²¹

The passage continues dialectically. Through attraction of opposites, a third thing is made, in this context it is generally called a salt. The combination of the acid and the alkali, however, 'finds, after this striving for unity, satisfaction', but only at the expense of destroying the chief characteristic of its component parts. The acidity of acid is no longer noticeable, and likewise the lixivility of the alkali, notes Runge, having ascertained this fact through tasting. Repulsion is described as a rejection that takes place between things that are already alike. A compound of unified acid and alkali can be separated if another 'stronger' acid or alkali is mixed in. Reciprocal action destroys the union and separates the first constituents in order to make another salt. 'Just as famously the devil can be driven out by Beelzebub, that is, one devil can be driven out by another, so here acids cast out acids and alkalis alkalis.'²²

In 1850 Cochius bought the Oranienburg factory where Runge researched. He dismissed Runge at the end of 1851, although Runge received a modest pension.²³ It was at this time that Runge published a book showing the results of his experiments with liquid chemicals.

BILDUNGSTRIEB DER STOFFE

Some say that Runge may have discovered the process by accident, when he dropped a saline solution onto blotting paper. The paper had previously been impregnated with other saline solutions, and Runge observed the circular and oval shapes that appeared. Or it may have begun because of Runge's frustration at deciphering the components of a solution in the usual way using test-tubes. There are various substances, compounds or salts that have such a peculiar effect on other substances that they can be used to test out what is present or to make it behave in certain ways. Potassium ferrocyanide, for example, is a substance that can be used to show if copper or iron is present in a solution. Depending on which is present, it produces red or blue compounds. Usually the substances under investigation are dissolved in a watery solution and mixed in a test-tube with a solution of the material under investigation. Runge complained of the difficulties of achieving correct quantities by such means and decided to get rid of the vessel.²⁴ Instead he mixed his solutions drop by drop directly on the blotting paper. However the process began, Runge enthusiastically developed his technique of dropping various chemical solutions onto each other on filter paper and scrutinizing the patterns and colourings that formed. In 1850 he published a book of images resulting from these experiments. *Zur Farben-Chemie*, whose full title translates as *On Colour Chemistry: Exemplary Images for Friends of the Beautiful and for the Use of Sketchers, Painters, Decorators and Cloth Printers (Represented through Chemical Reciprocal Action)*, was dedicated to His Majesty Friedrich Wilhelm IV 'as a public observance of deepest respect'. There were 120 images in the book, each image 4 × 5 centimetres in size, and pasted in by hand. The book began with the two chemicals that were 'the parents' of all that followed, one blue, one pale yellow and both in the shape of an egg, a form that suggests the origin of life. The parent chemicals were potassium ferrocyanide and copper sulphate. The process of generating images from these two parents is described by Runge in terms of a little drama, a love story. The two liquids are confronted by an obstacle – another liquid chemical – whose introduction disturbs their swift union.

And so they find it necessary to devise detours, in order to find their way to each other. In the course of doing this, materials get arrested or stuck, and the liquid evaporates. Everything calms down and the wild chemical wandering is now embodied in an image and fixed to the paper.²⁵

The book's subtitle named the process at work: 'chemical reciprocal action'. As was to be expected from a philosophically trained chemist, Runge expressed himself in dialectical terms:

The colours are isolated here and not isolated, they interpenetrate each other in their separation and separate out in their interpenetration. Such a thing can only be developed from the inside out as a natural growth. What are these pictures then? They are natural formations, which arise through chemical reciprocal action.²⁶

The image produced is a 'map' of chemical regions. This is its spatial axis. At the same time, each little image tells a story of its coming into being through time. Each image has a little 'plot', which is its temporal axis. Runge describes the results as indications of a hitherto unseen world.

Here was shown at once a new world of formations, shapes and mixtures of colour which I had, of course, never thought of before, never even suspected, and therefore whose actuality surprises all the more. Soon I learnt the circumstances under which these pictures not only appear in the most beautiful and various ways, but also how it is possible to reproduce them in any desired quantity. To discover this was particularly important for me, for thereby this discovery gained in addition to its chemical value, a value also for fine art, and it became possible for me to send these images into the world in their thousands as exemplary images.²⁷

The images could be reproduced in multiples and were always the same, as long as all the original components were still present in the same way: 'all the forces, substances and circumstances that were active or suffering in the first image, are the same in the second, the third etc'.²⁸ The same paper, the same liquids mixed in the same relationships and in the same amounts, and the same-sized drops must always fall from the same height. The process of making the images relied on the characteristic behaviour of the chemicals under investigation.²⁹

In such chemical experiments, which one calls analytical or dissecting, the first thing to determine is what elements one is dealing with, or to put this in chemical terms, in what quantities or mixtures the elements consist. To do this one uses so-called 'reacting means', that is substances that possess certain characteristics and peculiarities and which one knows precisely (either because of tradition or one's own experience). The changes that they effect or suffer are simultaneously the language with which they speak, and thereby they show the researcher that such and such a particular element is present in the mixture under question.³⁰

A language of chemicals is proposed, and this language is expressed in their behaviour. It is almost as if the chemist does not participate in this image production, this chemical articulation, when chemistry itself announces, 'Anch' io sono pittore!'; but more proudly than Michelangelo, for it does its work without a brush. Artists could learn from this, notes Runge, for here appear colours and colour combinations that have never been seen before.³¹ These shapes and colours follow a lawfulness beyond human capriciousness.

Whoever carefully considers the images in this book will soon realise that they cannot have been painted with a brush. The quite peculiar blendings and shadowings show that there can be no talk of the arbitrariness practiced by the brush. The same is true of the various colours, which could not be brought forth by an arbitrary composition.³²

Runge was less interested in chemically analysing the materials at work – these he knew in advance – but rather in discovering the circumstances under which these images turned out most beautifully. There were practical benefits too. That these could be reproduced in quantity meant that the images could be used to make un-counterfeitable paper money. Other money, notes Runge, can be counterfeited because what human hands have made, other human hands can make. That which forms from itself under quite specific circumstances can only be imitated or repeated by the person who knows precisely these very specific circumstances. Another person may be able to obtain something similar after much effort, but never something identical.³³

In 1855 Runge self-published a sequel to *Zur Farben-Chemie*. It was called *Der Bildungstrieb der Stoffe: veranschaulicht in selbstständig gewachsenen Bildern* (The Drive to Formation of Elements: Made Visible in Independently Grown Images). The word 'Bildung', formation, had been popular in scientific circles since the early 1780s when the physical anthropologist Johann Blumenbach published *Über den Bildungstrieb*. Goethe adopted the term *Bildung* in his study of plants. Goethe rejected Newton's insistence on a mathematical apprehension of nature, and he was suspicious of Kant's assertion of a realm of nature that was inaccessible 'in itself' to human understanding, knowable only through the conceptual categories of reason. Goethe wanted to enter closer into nature, and to do so through close observation. He devised a method, named and explained in the preface to his *Morphologie* of 1807. Morphology is the study of plants and animals through concentration on form and the discovery of homologies and affinities, similarities of pattern and layout. All this suggests common ancestry, or original forms. For Goethe, the future history of a phenomenon was unfurled from its primal appearance. But form, for Goethe, was generative and dynamic. Morphology investigates the inner formative forces rather

than external characteristics. Goethe criticized the doctrine of the Philosophy of Nature, which assumes that forms are only superficially different. For him, forms were variations stemming from a general *Bauplan* or blueprint. Goethe did not stress similarity but difference. If similar forms are laid side by side from oldest to youngest, for example the parts of a plant, what is seen is a series, and between each variation can be imagined the movement that shifts one form onto the next. The individual form cannot show the movement in itself, but its form is governed by it. Each part is an arrested stage of metamorphosis. Movement is the law that generates new forms. Morphology is the principle of such movement. Morphology is both spatial, in its study of the relations of parts, and temporal, in its examination of development through time. Goethe's preface expresses the need for such morphology by explaining two ways of characterizing the complex phenomena of nature. The word *Gestalt* is used to describe the shape or form of a phenomenon. This suggested to Goethe something rigid, fixed and detached from all other phenomena, once it has been isolated and identified as such.

But if we actually contemplate all the existing forms [*Gestalten*], especially the organic ones, nowhere do we find anything stable, at rest or complete and detached; rather we find that everything fluctuates in constant flux.³⁴

For that reason, the more appropriate German word for the type of investigation Goethe undertook was *Bildung*, which means formation or shaping. It designates, he notes, 'both the product and the process', to show that things are not static or fully contained in the concept, but generated out of movement. In a sense, use of the word *Bildung* suggests the Kantian idea that nature cannot be fully known, for it is too dynamic, always in process. However a more motile approach can win knowledge from nature, if it is aware of nature's effervescence. Theory is necessary, but it is an error to take the hypothesis or scaffolding for the thing itself or the building. Theory's claims must be set against careful observation. Nature in its smallest and largest parts is one. Any dullish looking glass shows the pretty blue of the sky.³⁵ Goethe observed the most restricted part and found infinity there.³⁶ The blue of the sky featured once more in a note of 1829:

The highest aim would be to grasp that everything in the realm of fact is already theory. The blue of the sky reveals to us the basic law of chromatics. Let us not seek behind the phenomena – they themselves are the theory.³⁷

Nature is its own theorist, its own voice. Theory is expressed in the phenomenal. Nature reveals itself to us, if we look closely enough. The 'scientists' must not come to the object with a preconceived set of hypotheses, for

that would drown out nature's voice. Goethe returns to the original meaning of the Greek word *theoria*: 'to behold'. Vision is emphasized. Sensitive observation is the starting point for discovery. Goethe cherished a tender empiricism that makes itself so identical to the object under study that it becomes its theory.³⁸ In the Preface to the first edition of his *Theory of Colours*, he asserts:

Every act of seeing leads to consideration, consideration to reflection, reflection to combination, and thus it may be said that in every attentive look on nature we already theorise.³⁹

He adds, though, that we should do so with 'mental self-possession' and without forgetting that we are so doing. In observing nature adequately we participate intellectually in its ceaseless production. Such practical seeing is met by a seething, energetic view of the field of vision. Goethe studied the process of seeing and the contingent nature of colours as they appear to the eye, or not just as they appear to the eye but how the eye makes colour seem. The eye is active in the process of looking, and colours are prismatic, fugitive and contingent. Some colours, in particular the colours of interference, those that issue from reflected rays off oil or soap bubbles, are produced as much by the eye that sees as by the object itself. All colours change, depending on the light in which they are viewed or the movement of the eye that sees. Some colours are produced entirely by the eye, as a response to external stimulus. Such colours include the colours of after-images cast by the eye after exposure to a rich source of colour and brilliant light or the colours of memory. Goethe endows the objects seen – and all the elements involved, such as light and the eye's particular structure – with the power of seeing or seeability. They work on vision in the production of their own reception. A meeting point is here described, a reflection of one thing in the other. All colours are ephemeral in some sense for Goethe, but of particular interest to him were those iridescent colours, prismatic colours, peripheral optical effects that demonstrated two things: the mercurial vivacity of nature and the labours of the generative – and educatable – eye.

The thing observed also played its part in the seeing. For Goethe the human mind enters into the essence of phenomena and listens to its voice. Nature operates according to ideas. It too is spiritual and expressive. The mind of the observer perceives the ideas operative in nature. Goethean observation led to insight. Goethe discovered the intermaxillary bone in the human jaw in 1784. This observation allowed the voicing of an idea already sensed: that there is a basic anatomical model shared by humans and higher animals, that is to say that there is unity in nature. In 1829 Goethe wrote 'Analysis and Synthesis'.⁴⁰ Here he notes that analysis, the popular scientific method, is meaningless because it only provides a perception of parts. The synthetic understanding is comprehension in the context of the whole.

Chemistry is in error where it is analytical for it separates out that which nature has united. Goethe provides the image of a pile of sand with gold grains. To discover what is in the pile the lighter parts need to be washed off and separated from the heavier parts. Then an analysis can occur. But the synthetic nature of the whole is broken. Understanding nature strives to get back to that synthesis on the basis of a knowledge of parts. Syntheses are intuitive, supported by and arising out of analytical work.

These inklings seem a world away from what came to be the dominant tradition in science. They evince an interest in nature as a totality, in a fluidity of subject and object positions, in an inclusion of the experimenter in the experiment, and in a strong sense of the aesthetic implications of scientific endeavour. The senses are the body's techniques and they have developed in conjunction with the world around them, with nature. The eye is as it is because of the light. The world of objects leaves its traces on our bodies and our memory, the resource that imagination evokes. Our development is a result of nature's speaking to us through our senses. We need to 'eavesdrop' on nature.⁴¹ Observation of nature mobilizes more than just the sense of sight. Goethe insists on a broader sensuous interaction with the world. These interactions through the senses are crucial to forming knowledge. He observed how astonishingly difficult it is to learn to see without using one's hand. Once a miner reported that Goethe lovingly handled those rocks that attracted his attention. For Goethe, the human was an 'exact instrument'.

Runge closes the description of his meeting with Goethe in 1819 by praising the man who was not just a poet but also a 'sensible researcher into nature'.⁴² Runge noticed in his visit how absorbed Goethe was in the process that Runge showed him. Runge was able to direct his deeply penetrating look at things that were quite new to him and whose significance he grasped immediately.⁴³ It seems that, along with the coffee beans, Runge also took away from Goethe an approach to the study of nature. Runge inherited something of Goethe's 'tender empiricism', a focus on the experience of the phenomenon. Through observation, which sets out from a notion of natural formation, *Bildung*, nature in formation can be perceived and understood. Runge adopted from Goethe a notion of mobile nature.

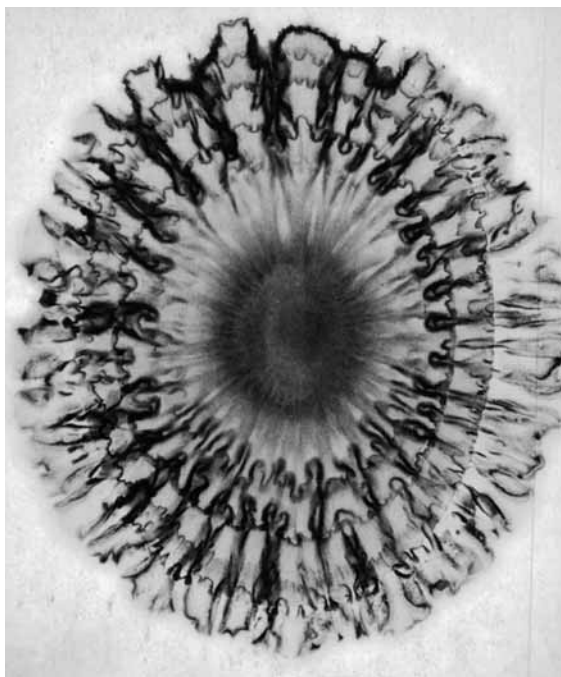
Der Bildungstrieb der Stoffe presented 32 experiments, in tipped-in images of around 12 × 14 centimetres. Each one had a commentary and revealed the chemicals at work in forming the image. Runge named the process of making the image the *Darstellung*, the representation. The image itself is the process, the process the image. The detail of the reaction is visualized in forms and colours. Each image was doubled, in order to show the regularity of the drive to self-formation. Runge acknowledged the role of paper in the process, active because of its capillary action, and, in reference to image no. 9, he noted the effects of oxygen in the air. Image no. 11 indicated the role of chance, since after the chemicals had been put on paper and left to dry, some ammonia gas that was developing in another part of the laboratory affected

the image, changing everything. Image no. 17 similarly owed its existence to chance:

By a happy coincidence (for it is without doubt that such a force must be at work with the emergence of such peculiar images never before seen by human eyes) I got hold of a solution of cooking salt when I wanted to drop red potassium cyanide solution on a manganese salt base, in whose centre there was some ammonium dibasic phosphate.

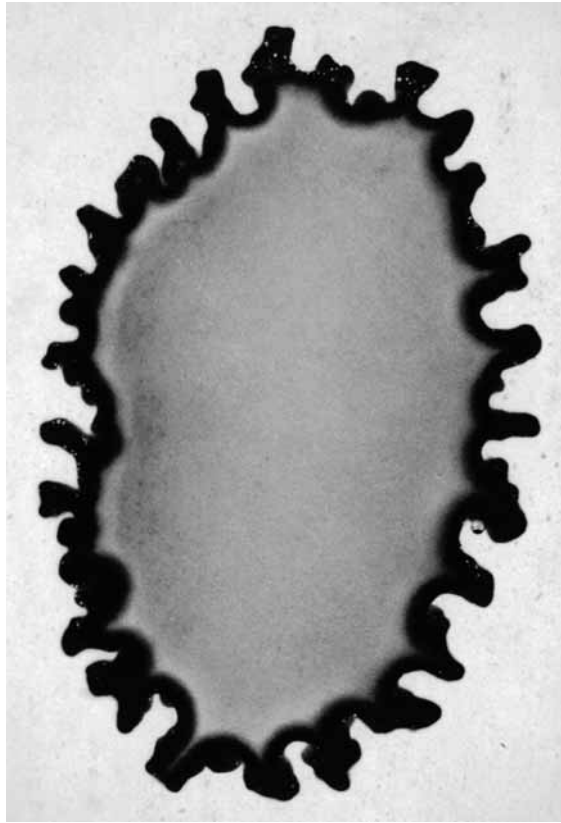
Of image no. 20 Runge noted that 'A great nature researcher says: nature reveals her secrets on the *surface*; I wish to add to this: and especially at the edges of this surface.'

The edges fascinated Runge because they were the representation of the last point of time in the history of the image's formation. The edges are the end of the story, for all activity emerges from the centre where the drop falls, and the edge is the furthest away point in space and time. Time is an essential factor. The paper must absorb each drop before the next is added. The *Bildungstrieb* must not be disturbed in its activity. Sufficient 'sustenance' must be given to the image to enable it to reach its full potential. For Runge, in such processes an 'elective affinity' is exhibited, although this phrase is only partially correct. Choice is indeed at work, but affinity suggests a relationship or similarity between the new partners. In fact, it is a case of



An image from Runge's experiments: elective affinity of chemical compounds.

From Runge's experiments: nature revealing her secrets at the edge.

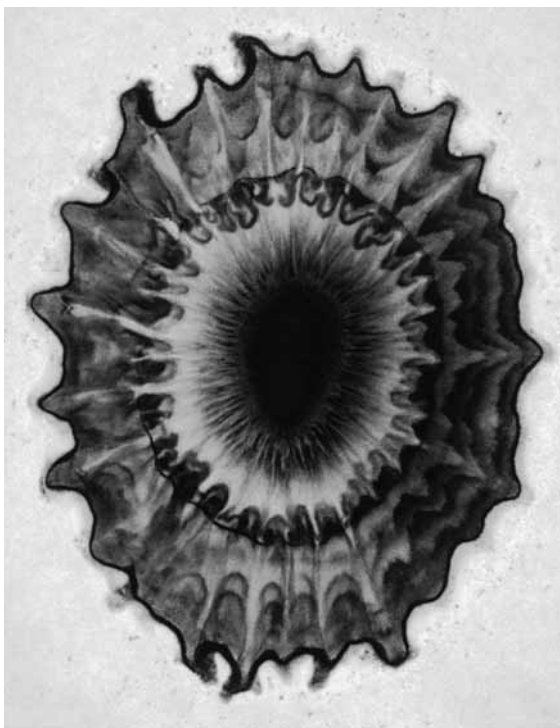


opposites attracting. Runge proposed instead the term *Wahlanziehung*, 'elective attraction'.⁴⁴ Furthermore, time and light are factors that never stop exerting themselves. It transpires that the image may continue to live even after its publication.

After some length of time a blueish halo forms on the border or the circumference of image number five. (Without a doubt now, when the reader casts a glance at it, it will most certainly have formed.)

Of image no. 12 he noted that the image itself, which is similar to the finest wood grain, demands for its presentation more attention than the previous images. The dropping on of the second liquid (the potassium hydroxide solution) had to occur after some delay and not immediately after the absorption of the previous drops, so that certain chemical processes had time to develop.

The concluding remarks of Runge's *The Drive to Formation of Elements* explain the procedures involved in his self-animated chemical experiments.

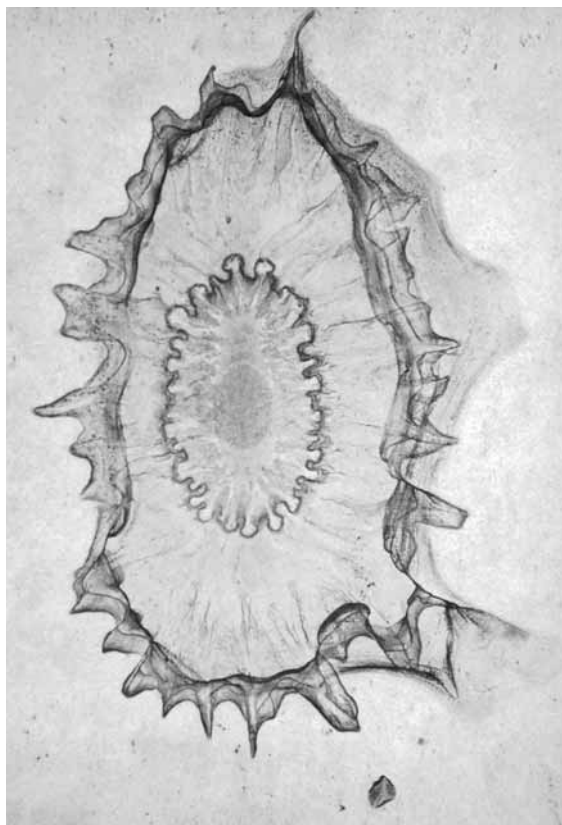


From Runge's experiments: making images grow.

The equipment consists of wooden frames strung with a net of twine, on top of which a sheet of paper is laid, and a disposable wooden spoon (to administer the liquids). This was an activity that could be carried out by everyone, and, once the chemical reactions were understood, quite simply. Runge boasts that in ten hours 1,000 identical images could be produced. In contrast, a painter, if he were even able to copy such an image, would need ten days to produce one. The *Bildungstrieb* paints in a different way to a painter. It 'makes its own colours, and hence, the wonderful, often quite *inimitable* colour tones', unavailable to the painter.⁴⁵ The images suggest other images to Runge – a ruffled lady's collar, a perfect flower, a huge Michaelmas daisy. Image no. 14 he describes as a green sea with brown banks, a *Fernsicht-Malerei*, landscape painting, more achieved than that of the 'most skilled painter', and, as he notes of image no. 15, whose use of light and shade was 'painterly', he had to develop this: 'Now the task fell to me to exploit this painterly art and to achieve, through various additions, even more perfect and expressive images.'

Image no. 31 is the painterly masterpiece of chemistry and it also shows that a chemical that acts destructively in one situation acts creatively in another.

From Runge's experiments: forces at work that speak to us about their nature and ours.



Its splendid *edge* with its artistically formed distribution of light and shade is deserving certainly of the closest attention, if one considers that nothing has been drawn here or painted with a brush, and that all effects always stem from the middle point (where the liquids are dropped).

Sometimes 'abortions' were produced, as in image no. 24, with its sprawling wings, a '*Schreckbild*' or horror vision, as Runge terms it, but it is included because it shows, like all the rest, regularity at work and the amazing force of the middle point, from which all movement stems. With image no. 27 Runge is curious to know what happens when two identical images in formation are placed close together. What happens at their edges when like encounters like? Do they embrace each other as friends or repel each other? Runge finds the latter to be the case. They fight with each other so as not to mix. Each image has 'retained its independence'.

Runge took chemical knowledge from observation. Nature reveals itself aesthetically. He was keen to show how every element involved in an

experiment asserts itself, or rather its will. Elements seek out each other. They respond to obstacles. Runge observed irreversible processuality, which is to say that he introduced historical process into natural forms, moving from genesis through becoming to completion. 'According to this, every little picture has a history of its coming into being, which it has experienced through chemical laws.'⁴⁶

The final images in the volume showed three stages of formation – its germ, its becoming and its completion. History inhabits the images, and if there is history then there is life. The image exerts itself in the chemicals' drive to shape themselves through mutual exchange, and so it can be said it has life. The chemicals move until they come to rest as image. Runge wrote: 'It is possible to say that the wet image still lives because (at least at the edges) it still grows.'⁴⁷

Runge believed that he had found out how to 'make images grow',⁴⁸ choose their own formations and destiny. Runge insists here that this image has a palpability. The images are almost identical on both sides of the blotting paper. This means that the image is contained within the paper, rather than residing on its surface. Holding against the light and observing that the images are darker rather than lighter can show this. The first editions of Runge's *Letters on Household Economics* had one of his 'chemical coat of arms' affixed. He notes once more of its formation that it is not made artificially, but arises naturally. Two colourless liquids were brought into contact with each other on the blotting paper and united to form a multi-coloured shape. The images were natural, which is to say human intervention and decision did not produce them, as is the case with a painting or an engraving. Paintings are only 'appearances', adhering to the surface that holds them. Runge comments that all paintings lack bodilyness. The image exists only on the surface. But these images have a body, possessing 'an actual bodily formation'.⁴⁹ This bodily-ness of the liquid formations is mirrored in the visual field. Runge's previously unseen images curiously bore some resemblance to the prime medium of perception, the eye. Doubled on the page they seemed even more like eyes. Runge stresses that the fascination of the process that has occurred is that it is *augenscheinlich*, apparent to the eyes, that it is *klar vor Augen*, obvious to the eye. Their eye-likeness seems to provide an analogue for Runge's sense of the life force as a kind of subjectivity possessed by nature and its elements. Perhaps the self-making formations 'see', or have perception. There are forces at work in them that speak to us about their own nature, and about ours.

Working at the same time as Runge with splats and blots of liquid was Justinus Kerner, who likewise saw a coming to expression in nature's own figures, a nature not normally visible to our senses, or perceptible with science's usual methods, but available to all those who followed his instructions. Justinus Kerner was a poet, a doctor who used magnetic healing and a ghost researcher. He wrote about somnambulism and other phenomena from what he called 'the night territories of nature' and the 'shadows of the

middle realm'.⁵⁰ His house was populated by visionaries and those who claimed to be possessed. It also hosted those who came to study them. Kerner's study 'Die Klecksographien' was written in 1857 and published posthumously by his son Theobald Kerner in 1890. Here he writes about how, by chance, he discovered a joy in ink splatters and blots – *Kleckse* means blot or splotch. In 1851 blindness had begun to set in. While he wrote, drops and blots of ink would fall on the paper without his noticing. He might fold the paper before these blots had dried, and then opening it up again, he would notice, especially if the blot had fallen near the fold, that symmetrical drawings had been formed, arabesques, shapes of animals or figures. These reminded him of an experience in childhood when, by accident or design, small, coloured berries or flies were crushed on folded paper, and drawings seemed to develop, without any help from a pencil or brush. Enraptured, he experimented further, and friends and welfare lottery organizers in Stuttgart and Dresden clamoured for the resulting images. School children and artists alike began to produce their own symmetrical blots in a 'klecksographical' craze. In Kerner's ink-blots, with their chance-filled symmetries, can be seen primitive images, idols, graven images, urns and mummies. Frequently there is a skeleton of a human being, or figures of men and women in general. There is something archaic and primitivizing about the images. They appeal to children. It is important, he notes, not to try to make something appear. This never works, though Kerner did endorse the addition of a few feather strokes here and there, once a basic image had emerged. The material itself is speaking and revealing. Unconscious blots tap an animated dark-side world. Forces are at work that have yet to be identified. These experiments – with chemicals, with ink – provide access to other realms.

Runge remarks in his concluding words on *Der Bildungstrieb der Stoffe* on the forces inherent in nature:

After everything I think I may now voice the assertion that, in the formation of these images a *new*, hitherto *unknown force* is active. It has nothing in common with magnetism, electricity or Galvanism. It is not excited or fanned by something external, but inhabits the elements from the very beginning and shows itself to be effective, when these balance out their chemical oppositions, i.e., combine and separate by elective attraction and repulsion. I call this force 'the drive to formation' and consider this to be the *model* of the *life force* that is active in plants and animals.⁵¹

The force that inhabits the elements of the picture, from chemical to paper, was named by Runge the *Bildungstrieb*, 'drive to formation'. Effectively Runge set aside any opposition between the principle of formation in various parts of nature. Runge's force is immanent, and it is the very essence of life. The only other early researcher into coal-tar had taken a more decidedly

arcane path along the same route. Money derived from his directorship of a steel company in Blanko enabled Reichenbach to purchase a castle, where he performed research into 'od' in the 1850s and '60s, after he heard tell of someone who saw colours emitted from a magnet in a darkened room. He discovered that crystals too exude od, and then he found that it could be traced in electrical currents, sunlight, moonlight, chemical reactions, heat, friction, sound, and in every living being. Every thing, animate or inanimate, exudes this stuff, be it a living thing or inanimate matter. Reichenbach's od is a force, and it is a polar force often manifested as two hues, red and blue, dependent on positive and negative poles, a left and a right, an above and below. But the only recorder of its presence was another human being, a 'sensitive' person whose body was an exact instrument attuned to perceive the odic light. Reichenbach tried but failed to photograph it.

Runge's willingness to attribute a life force to chemicals is a continuation of Romantic natural philosophy but meshed with Goethean morphology and experiment. Runge's natural philosophy, when it appeared at its most exposed form, emerged in the midst of close reference to the physical world and everyday life, embedded in wisdom about bad wine and hangovers and hints on the uses of sulphuric acids in the kitchen and for agriculture. The 24th letter in his collection on household economics was the most natural philosophical in tone and language, although it also echoed Goethe's 'The Metamorphosis of Plants' (1790). Runge describes the plant as a 'chain that continues into eternity, whose parts ceaselessly re-generate themselves'. The plant is 'immortal'. 'It is always past and future simultaneously'.⁵² Contradiction inhabits every aspect of the plant, from its first emergence to its decline.

All developments on earth are, namely, the result of two contradictory forces, the activity of the sun, on the one hand, and the activity of the earth, on the other. Both work in conjunction in order to form the corporeal world, which covers the surface of the globe in all its variety.⁵³

The complicity of these two basic forces is most visible in the plant. In it, light is transformed into earthiness and earth into sunniness, for the plant has an 'earth body' and a 'sun body'. One is rooted in the ground and follows the influence of earth forces: darkness and gravity. The sun body branches into the air and obeys the workings of the sunny forces: light and warmth.⁵⁴ This is how the earth began: the sun shone on stony earth and out of the decomposition of stones by weather forces arose plant life. Rooted plants live in the closest communion with their mother, the stony earth, and so their roots grow away from the light, pushing down into the darkness, obeying gravity. But responding to the energy of the sun up above, the stems strive for air and sunlight, and develop leaves in order to maximize exposure. While the roots seek liquid in the earth, the leaves strive for dry air. The root is colourless, the leaf green, a 'green burning flame, which spring ignites and autumn

extinguishes'.⁵⁵ With the emergence of leaves the sun now has the advantage, and, as the enemy of all that is low and undeveloped, the sun seeks to alienate the plant from the earth. A struggle ensues, a reciprocal action, out of which is born a new plant, on the plant. This is the birth of the bud. The sun has succeeded in producing a plant that belongs solely to the light. Opening and closing its petals, it breathes light, and becomes 'sun rays embodied in plant form'.⁵⁶ The earth fights back, and so only the pollen, the 'plant's spirit', can fly off, liberated, towards the sun.⁵⁷ The distribution of pollen is the 'freest act, that it can undertake'. 'The blossom becomes conscious of its plantly I-ness in the brightest sunshine'.⁵⁸ But this separation from the earth does not last for very long. The blossom's sublation of itself does not go unpunished. The dark earth spirit catches up with the fleeing plant soul and part of the blossom must serve this force. The stigma attracts the pollen and pollination occurs. This is the eclipse of the bloom. The perfume vanishes, the colours fade, the petals dry up. The flower returns to the earth as the corpulent fruit replaces the gentle blossom. This is the highest point of development, but it is also the point of reversal. The progressive upward development of the plant is over and its decay begins. The earth forces assert themselves. But the fruit is the reversal of a plant. The husk, which is its leaf, comes first and it contains within it its roots, buried in the centre of the fruit. A plant unfurls itself – the stem shoots out from the roots and the leaves come from the stem. Fruit life is different. It is a compression. The fruit leaf or husk grows around the fruit stalk and this encloses the roots. The fruit's root is to be identified for the first time, claims Runge, and he describes in this context the part of the fruit that nourishes the seeds, the seed's husk, which protects it like a glove. When the fruit splits, its seeds fall into the earth, into 'the realm of darkness and gravity' and the plant has now been reclaimed by earthiness.⁵⁹ Botanical life is beset by opposing forces and at each point contradictions, oppositions, mirrorings and reversals occur. For greenery multitude is expressed. For the fruit, oneness. For greenery there is plenty and excess, even waste with all the different parts of the plant and its multiplicity of leaves. The fruit, in contrast, is sparing. There is no excess of skin and all parts participate in the production of the fruit. There are also contradictions between blossom and seed. In the life of the blossom the governing factor is the freest generality. In the seed's life, it is the narrowest particularity. The blossom produces in excess, with its millions of pollen particles, in contrast to the seed's single, necessary presence. The life of the blossom is glorious, colourful, desirous of light and air. Its perfume is its spirit, dematerialized and airborne. The life of the seed is that of an orderly household. It is colourless, without smell, and its earthiness is expressed by its solid materiality, packed with starch, protein and gum.

Runge perceived in nature a dialectic at work. All is polarity, opposition, contradiction. Goethe too had recognized polarity in his analysis of colour, a quality that he insisted emerged from the conflictual interaction of light and darkness. But his polarity led always towards a progressive enhancement or

intensification. His plant studies were essentially progressive. Runge acknowledged Goethe's botanical teachings on the metamorphosis of plants from 1790. This was important work, he notes, but his conclusion did not go far enough. Goethe recognized only the progressive metamorphosis – a stage of climbing upwards – as essential to the plant, and he deemed this to be the regular state. 'Contraction' and 'expansion' mark themselves on the plant in its different 'leaves', from the seed leaves, through the stem leaves, to the formation of the calyx, the corolla, the staminal organs, the style and the fruit. But working alongside such polarity is another polar force, a movement of gradual development, 'enhancement'. Goethe does not mention a backward-stepping, declining force. Or if he does recognize it, it is judged irregular, a part of sickness. For Goethe, while the plant is growing regularly and healthily all is progress, for, from the first seed-leaves to the final ripening of the fruit, progressive metamorphosis is at work, pushing the plant forwards.⁶⁰ For Runge, in contrast, the forces at work are contradictory. There is a dialectic of progression and regression. Homology of form is tagged by reversal of form, and rather than an unfurling, the plant is the site of an intense drama of contradictory forces. For both, however, it is not the form itself but the development of forms that is traced.

Runge's letter on the life cycle of the plant was written for housewives. These letters brought chemistry into the home, even before it had been properly established as an academic discipline. The 36 letters covered a variety of themes, such as chlorine, sulphur, saltpetre acid, oxalic acid, vinegar, tartaric acid, soda, potash, soap, colouring Easter eggs, the magical powers of coffee and chicory, punch, artificial fertilization of cereals, and what to do with unripe grapes. Chemical processes were illustrated by anecdote, such as one on exploding bottles of fermenting beer and cider. Runge dealt with the experiences of local women. Some of them proofread his work. Some commented on the letters before they were published. Runge reported on conversations with women about chemistry and also the experiments performed by women in their households.⁶¹

MARX AND THE SENSES

While Runge taught the principles of chemistry to various parties, other theorists trawled through recent scientific knowledge in an effort to theorize social development. Dynamics and movement, a history of nature and in nature, analogies between the natural world and the human world infused Marx's thoughts. Marx, in his early works, insists that natural science had determined that nature is in a process of becoming prior to the appearance of humans. Nature develops spontaneously. The organic world is self-generated. Marx wrote in his manuscripts of 1844 on economics and philosophy:

The creation of the *earth* received a heavy blow from the science of *geogeny* – i.e., the science which depicts the formation of the earth, its coming to be, as a process of self-generation. *Generatio aequivoca* is the only practical refutation of the theory of creation.⁶²

Marx studied at the Gymnasium in Trier until 1835 with Johann Steininger, a follower of Abraham Gottlob Werner. At university in Berlin he attended lectures in anthropology given by Professor Heinrich Steffens, an important geologist, mineralogist and natural philosopher in the Schelling tradition. Steffens had heard Werner lecture on geology at Freiberg, seen Fichte and Schelling at Jena, and met Novalis, Goethe and August Schlegel. Marx's interest in natural science began with Werner and natural philosophy.⁶³ His early writings assert the unity between humans and nature. Understanding occurs through the senses, whose animation needs to be present in any scientific engagement. In *The Holy Family* (1844) Marx and Engels reflect critically on the development of materialism, which 'becomes *one-sided*':

Hobbes is the man who systematises *Baconian materialism*. Knowledge based on the senses loses its poetic blossom, it passes into the abstract experience of the *geometrician*. *Physical* motion is sacrificed to *mechanical* or *mathematical* motion: *geometry* is proclaimed as the queen of science. Materialism takes to *misanthropy*.⁶⁴

In contrast to this wrong development of materialism, Marx and Engels seek to reassert materialism in which knowledge of the material world or 'science' stems from sense perception, has 'poetic blossom' and values human perspectives. In his *Paris Economic and Philosophical Manuscripts* of 1844, Marx echoed Novalis's image of the miner, under the earth's crust, digging out beautiful gems for their aesthetic value alone. The miner, who knows and loves deposits for their own properties, is contrasted with the dealer in minerals, who desires them only as property. Sensuously stunted, the dealer 'sees only the commercial value, and not the beauty and peculiar nature of the minerals; he lacks a mineralogical sense'. Marx develops a theory of the senses. The senses confronted by an object can only respond to it, can only acknowledge its existence, 'insofar as my essential power exists for itself as a subjective capacity; because the meaning of an object for me goes only as far as my sense goes (has only a meaning for a sense corresponding to that object)'.⁶⁵ For example, music means something only to a musical ear. The senses of the 'social human' differ from those of the 'non-social human', because through socialization the 'essential powers' of humans have unfurled and been cultivated, and this is as true of the five physical senses as it is of the 'mental senses' of will and love.

The *forming* of the five senses is a labour of the entire history of the world down to the present. The *sense* caught up in crude practical

need has only a *restricted* sense. For the starving man, it is not the human form of food that exists, but only its abstract existence as food. It could just as well be there in its crudest form, and it would be impossible to say wherein this feeding activity differs from that of *animals*. The careburdened, poverty-stricken man has no *sense* for the finest play; the dealer in minerals sees only the commercial value but not the beauty and the specific character of the mineral: he has no mineralogical sense.⁶⁶

Poverty and pursuit of profit, these twinned opposites, maim the human senses. The dealer in minerals sees only money, another hard, inhuman substance – metal formed as symbol – when he sees his sellable jewels. For Marx, it is only through the humanizing of nature, working on its parts, making them objects for us, objects that confirm and realize our individuality that the object comes into its own and our senses greet it. The human essence is objectified in its world, in order to ‘make the human’s *sense* *human*, as well as to create the *human sense* corresponding to the entire wealth of human and natural substance’. Once we enter the realm of freedom, jewels and minerals will be appreciated for their beauty and their specificity truly and above all, and our senses will be able to perceive them in their true light.

But even if the mineralogical sense has been restricted under capital’s dominion, yet under conditions of exchange, the gems hold out a promise; the very notion of restriction of the senses implies a countervailing force – a sensual necessity – that strives to realize itself. The stony monetary value of minerals combined with their glorious aesthetic value, their pleasure for the eyes and smooth coolness to the touch, coexist in the object. The object is not completely lost, and can be loved still. For this to happen fully and unencumberedly, abstract – commodity – forms must be filled with sensuous, aesthetic meaning ‘for us’. They must be ‘humanized’. And humans, in order to experience humanly, must relate to the object in itself, valued for its qualities, rather than as an item for exchange, it meeting our senses cultivated for its reception. This heightened sense of aesthetic value, and sensuous particularity, is intrinsic to Marx’s materialism, and, as such, is an echo of the Romantic sensuous stance. The true relationship to objects is one in which the object is not objectified as such, but appeals to the beholder sensuously and specifically. The passage on minerals and the senses is the culmination of a discourse on species being and labour.⁶⁷ Humans, like animals, live from nature, but humans are universal beings, and can live from and transform all aspects of organic and anorganic nature. Humans live from natural products, in the form of nourishment, heating, clothing, shelter and so on. The whole of nature is the ‘inorganic body’ of the human, as a direct means of life and as the matter, the object and the tool of human life activity. Humans must remain in dialogue with their ‘inorganic body’ in order not to die.⁶⁸ In

this dialogue, nature is appropriated (and because humans are natural, they appropriate themselves), whether spiritualized in the form of art or made an object of science. This productive life is 'life-producing life' and, as such, as freely chosen and creative activity, constitutes the species-being of humans. That which is produced is an objectification of human thought and activity. This is reappropriated sensuously.

All his *human* relations to the world – seeing, hearing, smelling, tasting, feeling, thinking, contemplating, sensing, wanting, acting, loving – in short all the organs of his individuality, like the organs which are directly communal in form, are in their *objective* approach or in their *approach to the object* the appropriation of that object. This appropriation of *human* reality, their approach to the object, is the *confirmation of human reality*. It is human *effectiveness* and human *suffering*, for suffering, humanly conceived, is an enjoyment of self for man.⁶⁹

The appropriation of nature is an activity. It may be direct or it may be intellectual. In appropriating nature, humans enjoy their own creativity and ability to objectify and re-produce the world. But private property ruins this, making us 'stupid and one-sided', believing an object to be ours only when we directly possess it. Money supervenes and distorts the meaning of belonging. As long as private property exists human senses are stunted, and nature is stunted too in its reflection for us. We should have as many senses as there are objects, mineralogical, plantological, animalogical and so on. Each part of nature should speak to us in its own terms and in ours, not in money's, for money is only the symbolic version of metal and has lost its own expressivity. Under capitalism, labour occurs in an estranged fashion. Labour is not offered freely and what is made does not return to the producer in any meaningful way. Rather what returns is a portion of value of the object converted into money. What is produced has become alien. Its alienness is all the more disturbing, perhaps, given that it has the energy of the worker embodied in it. It is like an amputated limb. In estranged capitalist labour the process is valued less than the product, which is a commodity. Humans are alienated from their own body, from nature and from their spiritual essence.⁷⁰ Marx's aim was the return of sensuous, aesthetic experience to the individual. He drew on the sensuous materialism of Feuerbach to insist on sense-perception as the basis of all science. History is the preparation and development of human beings as objects of *sensuous* consciousness, and turns the requirements of humans as nature into their needs.

History itself is a *real* part of *natural history*, of nature developing into humans. Natural science will in time incorporate into itself the science of humans, just as the science of humans will incorporate into itself natural science: there will be one science.⁷¹

Technologies are developed over time in order to allow this communion with our anorganic body. In addressing nature through technologies we change nature, making its outputs historical, 'for us', who are also a historical part of nature. Human activity is a natural force, but also a force that works on nature. It is nature interacting with nature, to change it. History inhabits nature. Nature also inhabits history, in the sense that, in the early 1850s, Marx drew on the term 'geological formation' to name his notion of a 'social formation'.

In July 1858 Engels wrote a letter to Marx. He enthused about developments in comparative anatomy, physiology and organic chemistry. Before 1850 the important theme of popular science was natural history in general. But natural history was in decline as the century progressed and the three kingdoms of nature, mineral, vegetable, animal, were separated out and their study split into a number of specialized disciplines. Engels asked Marx to send him a copy of Hegel's *Philosophy of Nature*, since he was eager to see if 'the old man' had been able to 'scent something' of the new developments. Certainly, he observed, physics had substantiated one of Hegel's presuppositions, the correlation of forces. The force field of nature is governed by movement and transformation.

The law that under given conditions mechanical motion, that is, mechanical force (produced, e.g., by friction), is changed into heat, heat into light, light into chemical affinity, chemical affinity (e.g., in the Voltaic pile) into electricity, electricity into magnetism. These transitions can also take place differently, backwards or forwards.⁷²

Of this Engels notes: 'Is this not a splendid material proof of the way in which the determinations of thought are resolved into one another?' All of nature, like history, is dialectical, and dialectics is the intellectual mode of appreciating this. Furthermore, Engels' researches into comparative physiology provided him with

a withering contempt for the idealistic exaltation of man over the other animals. At every step one bumps up against the most complete uniformity of structure with the rest of the mammals, and in its main features his uniformity extends to all vertebrates and even – less clearly – to insects, crustaceans, earthworms, etc.⁷³

From the most primitive form, from the lowest plant up to the human ovum and spermatozoon and the parts of the human body, all is cell. The natural sciences had progressed rapidly in the preceding thirty years, and one reason for this was the use of the microscope, which, Engels insists, had been correctly deployed only for the past two decades. The microscope revealed this uniform origin:

Everything is a cell. The cell is Hegel's 'Being-in-itself' and its development exactly follows the Hegelian process, resulting finally in the 'idea', i.e., each completed organism.⁷⁴

The microscope can reveal this through its ability to allow vision to penetrate further into the structure of material. Seeing is enhanced. In his preface of 1867 to *Capital* Marx compares 'simple value' to a cell. Simple value form is only analysable through abstraction at a higher power, like the cell through the microscope. The commodity form of the product of labour is 'the economic cell-form'.⁷⁵ It is easier to understand the body as a whole, notes Marx, but for his dissection of capital it is necessary to strip the economic body back to its simplest form, the cell or 'the value-form of the commodity'. He observes that the analysis of these forms seems to turn upon minutiae 'of the same order as those dealt with in microscopic anatomy'.⁷⁶ Methods in natural science are transferred into an understanding of the economy. Natural history had discovered the forces behind direct perception, by looking closely enough, with sensitive eyes. But chemistry and the other new sciences now worked with scientific instruments and reasoning to reveal invisible elements such as molecules and atoms. They had seen the unseen, and could analyse, it, touch it, use it. These methods worked back on Marx's analysis of the social formation that aimed at its transformation. Marx's sensuous materialism and Engels' monism were in dialogue with scientific developments and could imagine their most progressive and utopian side: both the liberation of all nature and the liberation from a natural state of being, as much as from a contorted capitalist actuality.

COAL'S COLOURS

As the nineteenth century progressed, chemists and other scientists were busy investigating and reporting on all the elements of the world. Justus von Liebig, the most successful of German chemistry's popularizers, was asked to submit a series of articles to the *Augsburger Allgemeine Zeitung*. The first 'Chemical Letter' was published in September 1841 and there were six more that year. Further letters appeared in book form. The subjects included the circulation of matter in the animal and vegetable kingdoms, equilibrium in agriculture, bones and their use as fertilizer, ailments and the constituents of blood, the relation of animal and vegetable organisms, and the necessity of chemistry. The book was extended. By 1859 the fourth edition of 'chemical letters' contained 50 letters in two volumes. The success of these letters showed how deeply chemistry had penetrated industrially and socially. The era of the great chemical factories had arrived, and, in Germany, these were places of research, as well as production and commerce.⁷⁷ The main area of research picked up from Runge's discovery of cyanol. Some German scientists had emigrated to Britain to continue research in this area. August

Wilhelm von Hofmann, Liebig's former assistant, researched aniline with a group of young researchers there. Like Runge, they extracted and analysed various coal-tar products, using the residue left after the production of illuminating gas. One of Hofmann's researchers was William Henry Perkin, who in 1856 attempted to produce quinine, useful for combating malaria on colonial expeditions, from an aniline-like substance. Instead he made an unsightly brown slush. He treated it further with water and found that it formed a solution of purple. Then he found that violet crystals could be isolated, and this substance dyed silk and was fast and bright. Although Runge was the first to synthesize an artificial blue dye, it was Perkin who was credited with the discovery of synthetic colours, the first one named Tyrian Purple, and later mauve. Perkin gave up research in order to manufacture colours industrially. From this point on the investigations begun by Runge were taken up in earnest across Europe. Chemists set to work and coal-tar was made to release all sorts of colours. In 1856 Natanson and Hofmann found two different ways to make magenta. In 1858 fuchsine was prepared in Lyon. Its brilliant red caused a sensation. In 1860 Girard and De Laire made rosaniline blue. In 1861 came Paris violet. In 1862 alkaline blue arrived. In 1863 Hofmann made violet and Perkin made safranine. In 1864 came Bismarck brown, Parma violet and Bleu de Lyon.

In a guidebook to the World Exhibition of 1862 in London, Hofmann noted that extraordinarily beautiful colours were made from the most disgusting tar, and he expressed a technological optimism about the possibility of making all plant and animal matter synthetically and thereby 'making accessible to the many the basics of welfare and well-being that was previously only the privilege of the few'.⁷⁸ The World Exhibitions stoked competition between Britain, France and Germany. Not a single German colour factory was represented at the exhibition of 1862. France had led the way, but by 1865 British factories, with German chemists, were ahead, as Manchester Yellow and Manchester Brown led a new wave of azo-dyes. These used nitrous acid on aniline to produce a dye that could be printed directly without the need for a mordant. At the World Exhibition of 1867, more shades appeared. By now, Hofmann and other German chemists were enticed back to Germany to research. Britain had colour in abundance, for it had an empire that provided many sources of reds and blues in natural forms of madder root, cochineal and indigo. France squeezed her red from her madder roots. Britain drew red madder from her colonies in India. Germany had few imperial possessions but it had coal. The government supported the cultivation of a dye industry in Germany. Factories sprang up along the German Rhine and Main rivers. The Meister, Lucius & Co. factory was founded at Höchst near Frankfurt am Main in 1863 for the production of aniline dye. The first colouring material produced there was a red magenta dye (fuchsia). Bayer was founded in Barmen in 1863 by a colour merchant and a colour master. It employed one worker. In the early days colours were cooked up on the kitchen stove of the

owners. By the end of the first year there were twelve workers, a merchant and an apprentice. Within two years Bayer participated in the first aniline colour fabrication in the USA. In the first four years of existence it increased its workforce by 5,000 per cent. The Badische Anilin- & Soda-Fabrik AG (BASF) was founded in 1865 by Friedrich Engelhorn. It produced aniline coal-tar colours. By 1875 German colour works were well in advance of those in Britain, France and Switzerland. In 1877 a law was passed that protected German inventions as processes rather than products. This stimulated the quest for new methods of synthesizing the same products. At the same time, technical schools were established for intensifying chemical knowledge. By 1877 Germany was producing half of the world production of colour stuffs. In 1865 Friedrich Kekulé von Stardornitz, who had returned to Germany in 1858, discovered the composition of benzene's carbon and hydrogen atoms. Benzene, a colourless, odiferous, flammable liquid, one of the components of coal-tar and petroleum, had been first isolated by the chemist Michael Faraday in 1825, and, in 1845, Hofmann found it in coal-tar. Kekulé visualized benzene's structure – after two daydreams, one in 1854 on a London bus when he saw a dance of atoms, and one in the early 1860s when he saw a snake chewing its own tail – in a hexagonal ring. This recognition explained how carbon could make five or six times more chemical combinations than other elements. Aided by this discovery, Carl Graebe and Carl Liebermann at Bayer worked on the structure of alizarin in 1868, in order to reproduce it. Alizarin is the main red colouring agent in madder root. In 1869 they managed to make synthetic alizarin, from dibromoanthraquinone obtained from anthracene distilled from coal-tar. Together with Heinrich Caro, they simplified the process and made it industrially viable. The alizarin produced from anthracene was chemically identical to that in madder but it contained no impurities. It was also cheaper to produce. Natural dye products were unstandardized: for example, natural madder from Avignon, grown in a chalky soil, did not need to have clay added to it in such great quantities as the madder from Alsace, and young madder had less dye potential than mature madder. Now in synthetic form, absolutely predictable substances were available. Bayer began production of alizarin in 1870 and by 1871 a new alizarin factory was built. In 1874 this employed 64 workers. By 1877 Bayer produced and sold the most alizarin in the world, as 136 workers produced 6,000 kilograms a day. Other firms took up the chemistry. For example, in 1871 BASF marketed a red alizarin dye, followed by eosin, auramine and methylene blue. The construction and expansion of the chemical industry coincided with the combination of 25 German states into the German Reich in 1871. Through the Treaty of Frankfurt in 1871, Bismarck made it possible for the French to buy German intermediate dyestuffs more cheaply than the cost of their own manufactures.⁷⁹ The French industry withered away. Industrialization generated consumption and cotton usage per head in Germany rose by 500 per cent from 1843 to 1873.⁸⁰ All this material demanded colouration.

Indigo's secret took longer to be cracked (its deciphering swallowed up 18,000,000 gold marks and seventeen years of effort). Indigo was much desired, since natural indigo was a troublesome dyestuff. The indigo plant had to ferment for two weeks. The resulting greenish-yellow mass was then transferred to vats for further fermentation. It was beaten with rods to bring it into contact with air. This oxidation precipitated an insoluble reddish pigment that sank to the bottom of the vats. This was dried and cubed for marketing. It was not always pure and its impurities could wreck the dyeing process in factories. In 1864 Adolf Baeyer began to research indigo and in 1868 published a first formula. But it was not until 1880 that he achieved the first synthesis of indigo by using orthonitrocinnamic acid. This synthesis was, however, of little use because it was too expensive to produce. By the turn of the century production costs had sunk. Synthetic indigo was placed on the market in 1897. It destroyed British indigo production in India. By 1913 natural indigo was almost completely replaced.

A rainbow of synthetic colours appeared. Chemists had cracked the chemical structure of colour. Synthetic alizarin allowed thousands of new colours to be produced. Even the legendary Tyrian purple squeezed from the juice of molluscs was duplicated in German laboratories. Nature gave birth to a parallel world, a second nature – artificial colours, then later textiles, substances, any manner of materials. For Engels, the extraction of alizarin and its synthetic reproduction changed everything:

The chemical substances produced in the bodies of plants and animals remained just such 'things-in-themselves' until organic chemistry began to produce them one after another, whereupon the 'thing-in-itself' became a thing-for-us, as, for instance, alizarin, the colouring matter of the madder, which we no longer trouble to grow in the madder roots in the fields, but produce much more cheaply and simply from coal-tar.⁸¹

Philosophers, such as Hume and Kant, denied the possibility of exhaustive cognition of the world. The challenge to their insistence on mystery, insisted Engels, was practice, 'namely, experimentation and industry'. At the moment when chemists are able to reproduce a natural phenomenon and make it 'serve our own purposes into the bargain, then the ungraspable Kantian "thing-in-itself" is finished'. Engels, at least, hoped that nature, humanized, could now be 'for us'.

three

Shimmer and Shine, Waste and Effort in the Exchange Economy

THE NATURE THAT HURTS

Who made the colours? Once chemists cracked the codes, armies of workers carried out their instructions, toiling over great vats and boilers. Labour left its traces, such as those at Meister, Lucius & Brüning's factory, which was known as the *Rotfabrik*, the 'Red Factory', because of the durable dye left on workers' hands.¹ The chemicals left other traces, in lungs or on skin: ulcerations, cancers, dermatitis, aplastic anaemia, epitheliomatous growth, aniline poisoning, cyanosis, chrome holes and sores. Industrial diseases were another product of 24-hour factory operation with its 18-hour break-less shifts, sweated through by workers with no protective clothing.²

Using government reports and the like, Marx's *Capital* reveals the horrendous conditions in the textile industry in Britain, 'the classic ground' of capitalism.³ Textile manufacture propelled the Industrial Revolution. This industry led the way in the formation of the factory system, with its division of labour and concentrated sites of production. In cotton mills men, women and children were employed en masse, as 'hands', spinning materials harvested by slaves in the United States, weaving and bleaching the products, dyeing and preparing them for wear.⁴ In the 1840s adults and children worked for six days a week. The legal working day for young persons and women was around ten to eleven hours in the day or at night. The working hours of children between the ages of eight and thirteen was seven to eight hours a day. Men worked between twelve and fifteen hours day or night. In the silk mills conditions for children were harsher than elsewhere. Silk-working children were exempted from the education compulsory for all other factory children. Manufacturers excused this by saying that silk was such a delicate textile to work that it demanded a lightness of touch only acquired by early introduction to these factories. In 1850 Factory Acts attempted to limit some practices, but certain trades were excluded. Dye and bleachworks came under the provision of the Act only in 1860, lace and stocking manufactures in 1861. The 1860 Act decreed that, for dye and bleachworks, the working day should be fixed at twelve hours from August 1861, and from August 1862 at

ten hours, which worked out at ten-and-a-half hours on weekdays, and seven-and-a-half on Saturdays. Manufacturers fought to get calenderers and finishers excluded from this reduction in the working day. During that day, however long or short, working conditions were brutal. Girls in the bleaching and drying rooms were subjected to sweltering temperatures. They were crammed together ironing and doing-up in a tiny room by a hot stove, working late into the night, day after day. Phthisis, bronchitis, irregularity of uterine functions, hysteria in its most aggravated forms and rheumatism were common complaints, according to an inspector.⁵ Marx noted all sorts of evasions of the law and exclusions on special grounds.

A phenomenon as ephemeral as fashion caused so much of this suffering. Karl Marx aligns its rhythms with the mayhem of capitalist production, which *Capital* is keen to indict. 'The murderous, meaningless caprices of fashion', employing and discharging workers at whim, are linked to the general 'anarchy' of capitalist production. Marx refers to 'the season', when there is 'the sudden placing of large orders that have to be executed in the shortest possible time'. This habit increased with the development of communications, specifically railways and telegraphs. Marx quotes a British manufacturer on how purchasers 'give small orders requiring immediate execution, instead of buying from stock as they used to do'.⁶ Demand cannot be predicted before the season. The market dictates the rhythms of labour. Machinery is fixed and expensive. The flexible part of the system is the worker, laid off or brought in, depending on capital's whims and needs. The worker is the exact instrument on which will be measured the degrees of competitive exploitation. Workers jolt through their factory days, purely reactively.

Conditions in German factories were no better than in Britain. From the 1860s to 1890 workers had very little legal protection. They were subject to strict factory discipline and adhered to a *Fabrikordnung* devised by the employer. Factory regulations even extended to the factory-owned hostels where they napped. The working week was six days long. Workers worked up to 100 hours in a week.⁷ In the 1860s the working day could be seventeen hours long. In 1870 the twelve-hour day was decreed. Employment often ceased at the age of 45, since the worker was 'used up' by this age. From this point, workers were compelled to turn to the state for poor relief. During and after their time in the factory workers suffered from industrial diseases. There were higher rates of illness and accident in industries using chemicals compared to other industries. Workers were poisoned, suffered illnesses of the digestive system, the heart and the circulation, liver and kidneys, breathing, skin, or contracted tuberculosis. This could not be ignored and so, for example, at Meister, Lucius & Brüning's factory, from 1863, an accident insurance policy for employees was introduced. From 1874 there was a factory doctor who subjected all job applicants to a medical examination and oversaw health and safety. These early years of the chemical industry permitted vast accumulations of wealth in a very short time.

While humans were squeezed of their labour power, the rest of nature was subjected to industry, until eventually it could be reprocessed to make itself again, but more cheaply. Synthetic nature existed according to a new time. Industrial chemists struggled to produce these colours more cheaply than the processed products of nature, and more quickly. Synthesis speeded up the time of production. Marx noted this in *Capital*:

The recently discovered methods of producing iron and steel, such as the processes of Bessemer, Siemens, Gilchrist-Thomas, etc., cut to a minimum at relatively small costs the formerly arduous processes. The making of alizarin, a red dye-stuff extracted from coal-tar, requires but a few weeks, and this by means of already existing coal-tar dye-producing installations, to yield the same results which formerly required years. It took a year for the madder to mature, and it was customary to let the roots grow a few years more before they were processed.⁸

Speeding up production time, thereby heightening labour productivity, increases value. Developments in chemistry made this possible, and without demanding a considerable increase in total capital outlay through the installation of expensive machinery. Industry is a gigantic complex, in which changes in one area necessitate changes in another. Machine spinning made machine weaving necessary. These two demanded other mechanical and chemical changes in bleaching, printing and dyeing, so that the vast quantities of material could be made attractive and, therefore, sellable. For such great quantities to be made and dispersed worldwide masses of iron had to be forged into river steamers, railways, ocean steamers and telegraphs, all welded, cut and bored by huge machines. Machines now made machines, prime movers that could exert any amount of force, but precisely, indeed with a precision, accuracy and speed unachievable by any skilled human hand. While the production time and productivity of commodities was accelerated, expanded networks of communication and transport disbursed these into and across the globe more rapidly. The Suez Canal opened up east Asia and Australia to steamer travel. Months were turned into weeks and space contracts.⁹

CONNECTIONS AND RIFTS

In *Capital* Marx notes the way in which nature is humanly transformed.¹⁰ Animals and plants alter slowly over time through humans labouring on them. Nature is reworked by human activity, making nature directly historical. In order to write his genealogy of capital, Marx acquainted himself with contemporary scientific theory, so that he might understand this historicity of nature. From the 1850s until his death in 1883, Marx collated notes on

chemistry. He read among others Justus von Liebig, August Hofmann and Friedrich Kekulé von Staudnitz, because chemical developments played such a large role in the shift from the manufactory stage to the factory system of industrial production. Industrial chemistry met the demands for processing huge quantities of mineral, vegetable and animal substances, and chemical investigations introduced atomic and molecular theories, theories of chemical structure and binding, and the periodic system. Marx's notebooks tracked all this in hundreds of pages. His chemical interest was first stimulated by questions of agriculture and agronomy. In 1853 Marx noted that:

Changes in the soil's fertility and its *degree* in relation to society, and that is the only aspect of fertility with which we are concerned, depend on changes in the science of chemistry and its application to agronomy.¹¹

In 1866 Marx was working on the theory of ground rent for *Capital* and he found it necessary to consult the scientific writings of Justus von Liebig and Christian Friedrich Schönbein, proponents of 'the new agricultural chemistry in Germany'.¹² He found this work to be 'more important' than that of all the economists put together.¹³ Fertility of soil, its productiveness, 'although an objective property of the soil, always implies an economic relation, a relation to the existing chemical and mechanical level of development in agriculture, and, therefore, changes with this level of development'.¹⁴ The value of soil can be known, improved upon and altered in ways previously unknown to those economists who wrote on differential rent, given the contemporary insights of agricultural chemistry. Liebig's agricultural chemistry was of especial interest to Marx.¹⁵ Liebig described British high farming as a 'robbery system'. It was robbery because it was not fair exchange: something was taken and nothing given in return. Liebig conceived nature as a metabolic system of exchange. He developed the idea of an interchange of substances – *Stoffwechsel* – between different organisms. Plants consist mainly of carbon. Carbon is extracted from the air, an invisible nothing. As plants breathe in the carbon dioxide in the air, they analyse it chemically and take the carbon for their own growth. They exhale the oxygen that they do not need. Animals then use this cast-off. In return, animals exhale the carbon dioxide that plants need. As Liebig observed, a higher wisdom tightly links together the lives of plants and animals in a circuit of exchange.¹⁶ This is fair exchange, and essential to the life of the whole. But a rift within nature, or between the parts of nature, had developed. The 'robbery system' of farming disrupted metabolic exchange. The cycle was broken. The soil was depleted of its nutrients by heavy farming and, conversely, organic waste, an unassimilated, disease-provoking excrement, oozed from the concentrated populations in the cities where they lived and worked huddled together, stoking the great industrial complexes. In 1842 Edwin Chadwick wrote a 'Report on the Sanitary Condition of the Labouring Population of Great Britain', an influ-

ential text, which initiated the public health movement. Liebig took up these ideas in *Letters on the Subject of the Utilization of the Municipal Sewage* (1865).¹⁷ This considered how capitalism's separation of town and country, and the separation of livestock farming from grain and food production, was a system that undermined the fertility of the soil. Due to methods of farming, there was a depletion of elementary constituents of the soil, such as nitrogen and phosphorus, while the cities were swamped with human and animal waste. Drawing on an analysis of the composition of Thames water, Liebig argued that recycling could return to the soil the nutrients contained in sewage, and that this was essential since the city was effectively robbing the land. Capitalist agriculture was over-farming without returning nutrients to the land in the form of compost. This was a result of a widening split between town and country, or rather a one-way street from one to the other. As remedy, Liebig suggested the reimportation of waste back to the countryside. If all the solid and fluid excrement of city dwellers were collected and each farmer received the portion arising from produce he supplied to the town, his land would remain productive indefinitely and the mineral stores would not be depleted, despite a rising population.¹⁸ In the absence of recycled waste, human excrement, bones of dead soldiers and Peruvian guano were imported in massive quantity from abroad, and at huge cost, and, while dead soldiers might be an inexhaustible supply, guano was proving hard to locate in sufficient quantities.¹⁹ Liebig hoped for supplies equivalent to those in British coal-mines. In Germany, for the final decade of his life, Friedlieb Ferdinand Runge researched the production of artificial guano, synthetic dung, that 'not only completely substituted for Peru-Guano, but is also much less expensive'.²⁰

In place of metabolic exchange and a harmonic cycle of reproduction, an asymmetry had set in. Like Liebig, Marx wrote of the exploitation of soil, a theft of its nutrients without replacement. Marx drew out the social consequences of such depredation. Furthermore, the 'original sources of wealth' – soil, as producer of food, and worker, as producer of use-values – are alike the objects of capitalist attack, and nowhere more obviously so than in the city, where workers are crowded together and nature is most abused or repelled. With the increasing industrial population crammed together in the cities, two things occur. First, the historical motive force of society is concentrated, which provides the pre-condition of social revolution. Secondly, a metabolic rupture opens up, that is to say, humanity and the earth fall out of alignment, as humans consume, in their clothing and food, without replacement, elements, and so impede the lasting fertility of the soil, which is necessary to human survival. Human socio-economic organization threatens humans' natural survival. In the first volume of *Capital*, Marx concedes that capitalism 'teaches how to throw the excrements of the processes of production and consumption back again into the circle of the process of reproduction, and thus, without any previous outlay of capital, creates new matter for

capital.²¹ Productivity multiplies on the basis of a relatively small capital outlay. Waste can be made to give up a second batch of value. In volume Three of *Capital* Marx discusses how the capitalist mode of production extends the utilization of the excretions of production and consumption.²² The excretion of production is the waste of industry and agriculture. The chemical industry managed to find a way of efficiently reutilizing some of the waste that resulted from production:

The most striking example of utilising waste is furnished by the chemical industry. It utilises not only its own waste, for which it finds new uses, but also that of many other industries. For instance, it converts the formerly almost useless gas-tar into aniline dyes, alizarin, and, more recently, even into drugs.²³

The waste of consumption is human excreta, as well as the form of objects that remains after their consumption, such as clothing rags. Synthetic dyes owed their existence to the recycling of waste matter. But the excretions of consumption were largely squandered in the capitalist economy, as Liebig's example of wasted human excretion demonstrated. In volume Three of *Capital*, however, Marx writes of the wool industry and its development of 'shoddy trade', the reusing of fabric rags, which by the close of 1862 made up as much as one-third of the entire consumption of wool in British industry.²⁴ These shoddy clothes wear out two-thirds as quickly as other wool clothes.²⁵ The silk trade had developed in the same way, with increasing amounts of silk waste being used. Waste permitted the development of a parallel world of synthetics, fakes and substitutes.

GOLD ASSAY: THE MAGIC OF MONEY

Capital worked against fair exchange. Its very mechanism was asymmetric. But what was capital's mechanism of exchange? It was the most wondrous substitution of all. Exchange found a material body in money. And, for a while, the material body of exchange value was gold. A natural product, gold is everywhere, in all the earth and in every stone and in the water of the seas, but it is too dispersed to collect. A ton of earth crust contains about four milligrams of gold. Meteorites contain larger quantities of gold, and some scientists have speculated that the structure of meteorites mirrors the composition of central parts of our planets, and so, perhaps, there are large quantities of gold at the centre of the earth.²⁶ But on the earth, in its rivers and body, gold is hard won. Gold exhibits particular material qualities. It is on account of its rarity in quantity and its material nature that gold came to represent value in the form of money. In his analysis of the material of exchange, metalized money, Marx forces attention on to the materials themselves, and the role that the particular qualities of materials play in the activity

of the substance. This is consistent with his sensuous materialism. Marx specifies the qualities of gold, a money metal, evident still in the German word for money, 'Geld'. These natural material qualities are essential to the social role it comes to play.

A particular product (commodity) (material) must become the subject of money, which exists as the attribute of every exchange value. The subject in which this symbol is represented is not a matter of indifference, since the demands placed on the representing subject are contained in the conditions – conceptual determinations, characteristic relations – of that which is to be represented. The study of the precious metals as subjects of the money relations, as incarnations of the latter, is therefore by no means a matter lying outside the realm of political economy, as Proudhon believes, any more than the physical composition of paint, and of marble, lie outside the realm of painting and sculpture.²⁷

For Marx, gold is the purest, physically fullest metal, followed by copper, silver and iron. This purity is based on a number of attributes. Nearly all metals oxidize on exposure to air. Gold and silver, platinum and mercury do not. Gold is usually found glittering in its pure metallic state. The chemical properties of gold and silver are divisibility and fusibility, and yet as substances these two metals are uniform, and so equal quantities are able to possess equal value. Gold, especially, is found unalloyed, isolated, or, as Marx puts it, individualized.²⁸ In *A Contribution to the Critique of Political Economy* (1859) he notes that gold is found 'in pure crystalline state, as a separate substance not combined with other substances, or in a virgin state, as the alchemists said'. Mineralogically, gold and silver do not oxidize and so they remain over time pure, free of rust, which is to say they present themselves as that which they are. They do not perish. Gold concentrates a great deal of weight in a small space. Marx notes how the high specific gravity is matched by economic specific gravity (containing much labour time, i.e., large exchange value in small volume). Gold was the first metal to be discovered as metal, because it presents itself in nature as the most metallic, distinct, distinguishable, and, in its preparation, nature has carried out work that might, in other cases, be the task of artifice. Only crude labour is needed to discover and bring gold into use. There is no need for science or the employment of developed instruments of production. Gold is found in nature already in its finished state. Nature performs the technical work of washing gold in rivers. Gold may be extracted by only the crudest labour, sifted from rivers or alluvial deposits.²⁹ And so 'the absence of a need for skill or for machinery made the Gold Rush possible for all and sundry'. Gold offers itself up to the hunter. With its yellow tone it leaps out to the uneducated eye, whereas other substances would not appeal to 'scarcely awakened powers of

observation'. Gold, then, makes itself available, chooses itself in a sense as the metal of choice for money.³⁰ Gold and silver possess enormous malleability, which makes these metals suitable for ornamentation, and unsuitable for other uses. These metals are too soft to be used as instruments of production and so do not possess the use value of metals in general. But gold and silver are brilliant, and this sensuous quality suggests certain functions. The red-yellow gleam of gold and the bright whiteness of silver are attractive, and this, combined with their malleability, makes gold and silver so serviceable for jewellery, ornamentation and the addition of splendour to other objects. These metals are a 'positive expression of supra-abundance and wealth'.³¹

They appear, so to speak, as solidified light raised from a subterranean world, since all the rays of light in their original composition are reflected by silver, while red alone, the colour of the highest potency, is reflected by gold.³²

Marx turns to Jakob Grimm's *Geschichte der deutschen Sprache* (1848) to ascertain the connection between these metals and colour. The white shade of silver reflects all light rays in their original composition. The red-yellow of gold absorbs all colours of a mixed beam and reflects back only the red. This play with colour is noticeable, notes Marx, for the 'sense of colour, moreover, is the most popular form of aesthetic perception in general'. In addition to these aesthetic and material properties, there is the transformability of gold, between bullion and luxury item, that makes it so serviceable as money, 'which must constantly change from one form into another'.³³

Gold (the apparent marker of authenticity) is effective precisely because of its multiplicity and fluidity, rather than its self-constancy. Marx has much to say about the 'in-itself' qualities of gold. In *Grundrisse* (1857–8) and *A Contribution to the Critique of Political Economy* Marx plots a theory of materials, insisting that the particular matter of which an object is composed is significant. Material properties of a substance are not incidental to its object and purpose. The material of exchange, metallized money, is an especially good example of this. Money is a symbol, but the subject of that symbol is not immaterial. Marx forces attention onto the materials themselves, and the role that the particular qualities of materials play in the activity of the substance. Through this investigation of material properties, Marx insists on the non-contingent nature of form. The material of money is specific and necessary, and that necessary nature is a combination of many analysable factors, including aesthetic ones, incorporating the appeal to human senses, as 'matter, surrounded by a sensuous poetic glamour, seems to attract man's whole entity by winning smiles'.³⁴ But all these intrinsic properties of gold and silver show only why these metals come to play the role of money. Once in this role they become symbolic, taking on social characteristics, and here substitution sets to work. As he puts it:

Nature no more produces money than it does bankers or a rate of exchange. But since in bourgeois production, wealth as a fetish must be crystallised in a particular substance, gold and silver are its appropriate embodiment. Gold and silver are not by nature money, but money consists by its nature of gold and silver. Gold or silver as crystallisation of money is, on the one hand, not only the product of the circulation process but actually its sole stable product; gold and silver are, on the other hand, finished primary products, and they directly represent both these aspects, which are not distinguished by specific forms. The universal product of the social process, or the social process itself considered as a product, is a particular natural product, a metal, which is contained in the earth's crust and can be dug up.³⁵

Nature and the social collide. Gold is just gold, and gold is money. Gold and silver, when serving as money, magically became natural objects with strange social properties. Marx's materialism emerges out of French and English materialism, but it also draws from natural philosophy and Romantic ideas. It is aesthetic, sensuous and yet such an approach is no less effective as a research method in experimental or economic science. Such a heightened sense of aesthetic value and sensuous particularity is not incidental to Marx's materialism. It is at its core and persists. Marx's account of how gold is turned into money tracks the most transformative, seemingly magical act on nature by the human social world.

A SHORT HISTORY OF GOLD'S DISAPPEARANCE INTO SYMBOL

Political economists struggled with the hexes at work in questions of value and its representation. The 'father' of political economy, William Petty, of whom Grainger notes 'he was an excellent chymist and anatomist; and a perfect master of every other kind of knowledge that was requisite to the profession of physic', wrote some urgent notes on money and its unequalness to itself as part of his campaign for a Bank of England. Petty's concern, in *Quantulumcunque concerning Money* (1682), was that money be equal to itself. Money made of gold and silver is the best rule of commerce and must be equal, or else it is no rule, and consequently not money but 'bare metal, which was money before it was worn and abused into inequality'. Petty insisted that 'all must be like', and so worn or damaged money must be reminted and new coins made of equal weight.³⁶ Money must be cherished not for the images stamped upon it, but for its solidity, reliability, its setting of standards. Petty asserts money's existence as a quality true to itself, rather than a symbol of something else, rebuking those 'few such fools as take money by its name, and not by its weight and fineness'. Its fineness might, however, become a problem, if it existed amongst damaged money. Petty bemoaned a serious problem of hoarding on the part of those too attached to the image of their

money, and who consequently refused to exchange it. The aesthetic value of money exceeds its exchange value: 'bad and unequal Money may prevent hoarding, whereas weighty, fine, and beautiful Money doth encourage it in some few timorous persons'. In 1672 it had been the case that the attractive new milled coinage with the image of Britannia tended to disappear from circulation, as did the new silver coins. Worn, unattractive hammered coins and tokens continued to circulate, thus leading to a debasement of the state of money itself. Small coins became lost or wore away or the metal was clipped. Money became less than equal to itself. As Marx put it later in *Capital*, describing the coin's journey to the 'melting-pot':

During their currency, coins wear away, some more, others less. Name and substance, nominal weight and real weight, begin their process of separation. Coins of the same denomination become different in value, because they are different in weight. The weight of gold fixed upon as the standard of process deviates from the weight that serves as the circulating medium, and the latter thereby ceases any longer to be a real equivalent of the commodities whose prices it realises. The history of coinage during the middle ages and down into the 18th century records the ever-renewed confusion arising from this cause.³⁷

The age-old royal debasement of the unit of money, as well as the problem of clipping, concerned economists. As John Locke put it in 1695, the unit was and should be a definite weight of bullion, which must not be altered.³⁸ Silver as money is a measure on account of its quantity, its 'intrinsick value'. Silver's economic value is guaranteed according to a standard settled by 'publick authority'.³⁹ Locke had the ear of Isaac Newton, whom he met in 1688 at the Earl of Pembroke's house. Newton was made Warden of the Royal Mint in 1696 and he undertook a recoinage, where nothing concerned him as much as counterfeiting of the realm's coins. Signs were failing to match up to their significations. These first bourgeois ideologues were working on the very metal of the regime. Milled coins were produced to counter the fakers. Their edges made clipping and cutting and counterfeiting quite blatant, exposing bad money. Through milling the nominal and the real might be more firmly entwined. But other changes were underway. In England goldsmiths' receipts were turning into banknotes effectively. The tendency of coins to wear away suggested the feasibility of a fully symbolic material. It underlined the separation of value, metallic value, monetary value and weight. Perhaps banknotes would settle the problems of money's potential non-identity to itself. Paper money, which had been around since the seventh century AD in China, became more widespread in the seventeenth century. In 1694 the Bank of England was founded. Its pressing concern was to procure funds for the war of the League of Augsburg by taxation and a permanent loan. A desperate financial situation had arisen and the issue of a million-

pound lottery loan with large cash prizes for winners had been one scheme that prefigured the birth of the bank. The bank began the issue of notes in return for deposits. Each 'running cash note' carried the corporate emblem: Britannia seated gazing at a bank of gold coin. These large sheets of paper, handwritten, black-and-white and one-sided, could be redeemed for gold or coinage. The paper notes could be made to stand for any amount, and were redeemable only by the person named on them. They were an acknowledgement of deposit of coin. By 1698 less than half of England's money was coin. Significant transformations were underway. Money was turning into paper. Paper could be transmuted. While turning lead to gold was only an alchemical fancy, paper might be transmuted into gold still locked in the ground, as long as it bore the signature of authority. The alchemists, employed, for example, by Philippe, duc d'Orléans in the hope that they would produce gold, fell out of favour once paper money appeared as a more effective way to redeem debts.⁴⁰ The Scottish financier John Law arrived at the French court promulgating his paper money schemes. That paper, so banal a material, could be exchanged for gold was a fantastic gimmick and worthy of alchemical acclaim. Law established a note-issuing bank in 1716 to help out in financing the bankrupt French court after the death of Louis XIV, who had run up vast debts from endless wars and the lavish outfitting of palaces. But Law's paper schemes all turned out badly, with notes over-issued, precious metals and jewels sent abroad, bubbles burst, and deep and long economic crises produced.

By the middle of the eighteenth century printed denomination notes existed in Britain, though it was not until the middle of the nineteenth century that the first fully printed notes appeared and released the cashier from the personal touch of furnishing the bearer's name and signing every single note. Far from being tokenistic, notes proved durable, for they survived a tremendous crisis in 1797 when the long years of war with France drained gold reserves such that the bank suspended the convertibility of note to coin. Money men found out that the bank's credit did not depend on the convertibility of notes into gold, but on the more illusive factor of confidence. If confidence in the bank was maintained, then business could occur, conducted on a foundation of inconvertible paper money. 'Payable on demand' became the lie that underpinned actuality.

MONEY AND PHILOSOPHY

Gold was metamorphosing into paper, and philosophy followed. Money is both a material and a metaphorical resource, and money's own historical development proves how tangled up those two aspects actually are. It was a matter of coining phrases, and the economic was tangled with the expressive as analysts accounted for the new bourgeois reality of trade, circulation, exchange. In a mocking of categorical rigidity, with its dully empirical sense-

perception and mind-embossing objectivism, Hegel, master of historically and dialectically determined knowledge, observed how notions of truth were shifting along with the vaporizing of coinage into symbol and promise in his preface to his *Phenomenology of Spirit* (1807):

‘True’ and ‘false’ belong among those determinate notions which are held to be inert and wholly separate essences, one here and one there, each standing fixed and isolated from the other, with which it has nothing in common. Against this view it must be maintained that truth is not a minted coin that can be given and pocketed ready-made.⁴¹

For Hegel, truth is historical. If it is historical then it is flexible, shape-shifting and index-linked to developments across time.⁴² Truth is like the note that has worked free of its metallic equal, invading the realm of the symbolic. Hegel’s emphasis shifts to the concept of illusory being or semblance, in German, *Schein*, which is also the word for banknote. Regimes fix values in coin and note, but the promise of eternal security is undermined by inflation, devaluation and speculation. Its material form – its natural aspects – also continue to assert themselves in wear and tear.

Gold, a genuine natural product, found in its pure state and used with little effort or processing, comes to function historically in a social relation. This social relation fetishizes gold not as material but as money. Its money-ness becomes more significant than its natural predisposition. The sensuous appeal of gold, its aesthetic value, pales in relation to its exchange value. At the same time, however, its very material substance, which had been the reason for its presence in the role that it performs, works against its functioning. As Marx wrote:

But the circulation of money is an external movement and the sovereign, although *non olet*, keeps mixed company. The coin, which comes into contact with all sorts of hands, bags, purses, pouches, tills, chests and boxes, wears away, leaves a particle of gold here and another there, thus losing increasingly more of its intrinsic content as a result of abrasion sustained in the course of its worldly career. While in use it is getting used up.⁴³

There sets in a divergence between the existence of metal as coin and its existence as a piece of gold or silver. The coin becomes a ‘shadow’, ‘increasingly ideal’, ‘its golden or silver substance being reduced to a mere pseudo-existence’, which continues to perform the function of a legal coin. This sets it apart, as money, from any other matter involved in a chemical reaction.

Although friction with the external world causes other entities to lose their idealism, the coin becomes increasingly ideal as a result of

practice, its golden or silver substance being reduced to a mere pseudo-existence.⁴⁴

Circulation, notes Marx, has a natural tendency to convert coins into a mere semblance of what they profess to be, into a symbol: *Goldsein* (gold's being) becomes *Goldschein* (gold's illusory being or semblance). As semblance, it continues to function, until the point when its token nature cedes to an actual token, copper, tin or paper. As Marx puts it, the needs of currency circulation force all countries with a developed circulation to ensure that metal tokens function as coin irrespective of the percentage of metal they contain or lose. These coins are symbols of gold coins not because they are made of silver or copper and are of lesser value, but precisely because they have no value.⁴⁵ The signifier of value is its opposite, worthlessness. Marx comments:

What was originally an insignificant divergence of the nominal content from the actual metal content of metallic currency can therefore reach a stage where the two things are completely divorced. The names of coins become thus detached from the substance of money and exist apart from it in the shape of worthless scraps of paper. In the same way as the exchange-value of commodities is crystallised into gold money as a result of exchange, so gold money in circulation is sublimated into its own symbol, first in the shape of worn gold coin, then in the shape of subsidiary metal coin, and finally in the shape of worthless counters, scraps of paper, mere *tokens of value*.⁴⁶

In the process of circulation gold becomes a token of its own value so tokens of value could be substituted for it. This paper money, this substitute, is what the industrialized populace got their hands on. But it does not matter that the matter of money is now valueless. Capital has conjured other value-enhancing forces into being. Money's symbolic excess slips into Marx's delineation of money's powers. It is not only able to maintain its value while losing its substance. It can transform those who possess it. The human personality is transfigured through the magic of money: ugliness is turned into beauty, base becomes noble, old made young.⁴⁷ Money changes fidelity into infidelity, love into hate, hate into love, virtue into vice, vice into virtue, servant into master, stupidity into intelligence and intelligence into stupidity.⁴⁸ But money itself is the thing that experiences all this: it eats, it drinks, it goes dancing and to the theatre, it appropriates art and political power. It can buy everything.⁴⁹ Marx cites Goethe's *Faust*: 'money is now pregnant', or money has love in its belly: 'Geld hat Lieb im Leib'.⁵⁰ Money begets money, so it would seem, when it turns into interest-bearing capital. In the *Economic and Philosophical Manuscripts* of 1844, Marx reflects on a passage in *Faust* in order to explicate the nature of money. He quotes Mephistopheles:

What, man! Confound it, hands and feet
And head and backside, all are yours!
And what we take while life is sweet,
Is that to be declared not ours?
Six stallions, say, I can afford,
Is not their strength my property?
I tear along, a sporting lord,
As if their legs belonged to me.⁵¹

Marx analyses the passage:

That which exists for me through the medium of *money*, that which I can pay for, i.e., which money can buy, that *am I*, the possessor of the money. The stronger the power of my money, the stronger am I. The properties of money are my, the possessor's properties and essential powers. Therefore what I *am*, and what I *can do* is by no means determined by my individuality.⁵²

Marx could have looked to part II of *Faust*, for here is the attempt on the part of the Devil's accomplice to prove that wealth is endless, just not seen.⁵³ The tale is one about money's power to bestow omnipotence upon the individual. At least, that is the promise.⁵⁴ Mephistopheles plots to convert the clapped-out Imperial land where he and Faust reside as guests from gold currency to a paper-money based system. Once this is done they may develop productive forces in the coastal area, mobilizing a workforce to generate wealth. The paper plan will give them real power. Goethe had experience in this regard. In the autumn of 1775 he left Frankfurt to visit Weimar at the invitation of the young duke Karl August. He became the duke's close personal friend and organized court theatricals. In 1776 he was given rights of citizenship and assigned administrative responsibilities in the tiny duchy. These included financial affairs, and building works. Mephistopheles's solution is simple. He convinces the emperor by purely asserting the existence of all the wealth that is but hidden in nature's core. Surely a promissory note can be made for the value of such gold, this natural resource. The world itself is turned into the quintessence of money. Mephistopheles promises indefinite growth. There is no limit. The fluid of exchange is all, the material that backs it is nothing but a fantasy. The terms reverse. Money is fetishized. The basis of the empire will shift from the solidity of metallic gold to insubstantial promises on paper. Wealth lies dormant, and the production power of labour is disregarded as part of the valorization process. His case is won, as is revealed later in the Emperor's Garden, when the chancellor crows about the paper money that has 'transformed all grief into contentment' and which is 'secured by the immense reserves of wealth safely stored underground in our Imperial States.'⁵⁵ The emperor signed the note and 'quick conjurors made copies by the thousands':

To guarantee that all may share this blessing,
at the same time we placed your name on a whole series;
thus tens and thirties, fifties, hundreds too are ready.
You can't imagine how this pleased your subjects.
See how the town, so long half-dead and mildewed,
is full of life and teems with pleasure seekers!
Although your name has long been much beloved,
never before has it been viewed with such affection.
The alphabet is really now superfluous,
for in this sign can all men find salvation.

Mephistopheles reveals how these bits of paper can set a world in motion, by the power of promise, and buy sex and affection, far quicker than can wit or eloquence. Lethargic wealth hidden under the ground has become animate, released by the dynamism of capitalist development. And all know where they stand, for value is stamped on each paper note, underpinned by the multiply reproduced signature that guarantees.

As gold turns to paper, so too all the natural world finds its shoddy analogues. And these objects, real or fake, attract to themselves all the lustre of gold through the workings of what Marx termed commodity fetishism. At the beginning of a period when the masses embraced or had thrust upon them synthetics, ersatz-materials, things whose relation to the natural world was mediated beyond recognition, Feuerbach observed a tendency of the age of burgeoning capitalism. In his Preface of 1843 to the second edition of *The Essence of Christianity*, he observed how the present age 'prefers the sign to the thing signified, the copy to the original, fancy to reality, the appearance to the essence'. In this age 'illusion only is *sacred*, *truth profane*'.⁵⁶ Feuerbach sought to counter this, rendering the truth, making material the illusions of religious fantasy, turning the object of imagination, god, into the object of reality, humans, and thereby exposing the human essence beneath divine appearances. Feuerbach's object of attack was religion and Marx mirrored his logic, transposing the characteristics of religion to capitalist commodity society. For Feuerbach humans imagine idols who represent ideal forms of the powers inherent to them, and for Marx commodities appear to adopt human characteristics in the actual process of production. On the first page of the first volume of *Capital*, Marx defines a commodity as an object outside us, able to satisfy human wants. These wants may spring equally from the stomach (*Magen*) or from fancy (*Fantasie*).⁵⁷ Commodity objects are conduits of desire. But commodities are brought into being through a peculiar process of production that fetishizes them. Commodity fetishism is the substitution that characterizes the epoch of capitalist industrial production. Producers work on inanimate objects, shaping them into commodities. The connections between workers, their social bonds as transformers of nature, are obscured in the process, as they confront each other as things, seller of

another commodity, labour power, the energy and intellect that powers the machine and makes the things.⁵⁸ In contrast, the manufactured commodities seem to take on subjective powers: the capacity to alter lives, the ability to spawn great quantities of wealth. Marx wrote of the fetish that makes commodities seem animated, more lively than their makers. This is the source of their power and their appeal. Fetishism makes the commodities, and money, appear more animated, more important, more masterful, than their makers and users. 'Calico soars', 'rubber falls' read the financial headlines, as if the commodity had a life of its own. This has resulted in something quite different from the self-determining impulses that Runge found in chemicals and Goethe in plants. The object does not speak, rise, fall, assert itself. The commodity does this. The commodity fetishism, which Marx's *Capital* diagnosed as the flaw in bourgeois rationality, is an animation *gone wrong* of the object world. Far from drawing humans nearer to unblinking recognition of the inner dynamics of nature, and ourselves, capitalism and its fetish of commodities negates the humanness of humans, replacing our self-determination by the size of our wage packets and our relation to the means of production, while the spiritualization of nature turns into nature as ideology, as alibi and as zone under threat.

Twinkle and Extra-terrestriality: A Utopian Interlude

ANALOGY

Imagine a young tramp in an Underground station. Suddenly he is beside a girl in the diffuse, dull, orangey light. Inside this Underground station is a jeweller's shop. Perhaps she is waiting for someone, or simply killing time. She is looking at watches in the shop window just as the tramp approaches. He blurts out a drunken chat-up line. She asks him, divertingly, which watch he would take if she smashed the window. He says he does not need one, because, '*he* is a watch. He is always watching.' This was an exchange, in various senses. Exchange is the *modus operandi* in commodity spaces, but underground, in the underworld, things are wont to go awry. There is no commodity exchange here (she offers to steal the watch, he refuses the watch), but there is the exchange between the tramp and the girl, an exchange of words and glances, a social, human encounter. There is too the exchange of properties, words sliding into each other, human turning into object, object into human.

The tramp escapes the disciplining strictures of capitalist work correlated to time. The tramp lives within unpunctuated expansive observation. The tramp's pun – now mine – plays on the watch as timepiece and to watch as an act of observing. Watch was the name for the ancient divisions of the night and as such entered into sea-faring language, the watch being a period of time when each of the divisions of a ship's company would remain on deck. The tramp refuses the divisive marking of time by the clock. That industrial-era fetish eludes him, for he does not need it, but he retains the other sense of watching, actively scouring the heavens or, in a modern setting, the urban crowd. The tramp is another one of those modern observers all actively on the look out for something: detectives, prostitutes, flâneurs, cinema-goers, for whom, as Walter Benjamin tells us, 'the joy of watching prevails over all'.¹ The modern city upgrades the capacities for looking. In the nineteenth century commodity-crammed shops yearned for eyes to glance through windows, and cafés enabled the leisured to spy on the world. These glass surfaces reduplicated and reinforced a modern joy in watching.

But in the tramp's pun there is something more. The tramp *is* a watch. He refuses division itself, the division between him and the objects in the window. As much as he marks time, he is the watch, the watch is he, and it sees with his eyes. The anecdote touches on a collapse: the collapse between self and things. Through the conflation of watch and watching, mimesis, identity is expressed between tramp and object. There was after all a doubling for these two. Both tramp and watches have a face.

Dislodged from the machinations of modern times, the tramp re-accesses a seeing shielded from most, and said to be present in the mad or the infantile. It is as if he understands the world and its objects magically, in a cosmic connectivity that is violently and disastrously excluded by modern rational society. The tramp's mimetic reflection occurs in the dimly lit Underground, as the girl gazes into a brightly lit shop window, crammed with baubles. Both tramp and girl meet in a dreamspace, where words transmute and objects are elusive. That passageways and shop windows might well be the space of reverie and arcane knowledge was known by the arrangers of shop windows and designers of shopping spaces. Window displays were designed to evoke fantasies and conjure up dreams that commodities might make come true. The arcades were such dream spaces.

GLEAM, PHOSPHOR AND GLITTER

Inside the arcades, the ur-architectural phenomenon of the nineteenth century, transitional colours, twinkle, glimmer and reflection danced, and all the more charmingly as night fell. In the early days the gas lighting, whose illumination was an uneven flickering, cast a sparkly sheen over everything. In the arcades, their historian Walter Benjamin claimed, 'falsar colours are possible',² and everything is doused in a special 'glaucous gleam',³ which is reminiscent of aquariums, as Friedrich Gerstäcker imagined in a fictional transposition and, after him, Aragon made so vivid in *Paris Peasant*. In Gerstäcker's *The Sunken City*, the hero sees, to his amazement, that

with the gradual infusion of twilight, these undersea corridors just as gradually lit up by themselves. For everywhere in the bushes of coral and sponge were sitting broad-brimmed, glassy-looking medusas, which already at the outset had given off a weak, greenish phosphorescent light that quickly picked up strength at the approach of darkness and now was shining with great intensity.⁴

The arcades are zones of special effects where optical illusions, tricks of the light and transformations readily occur. This is why the arcades appear so magical, but it also intimates something of their propensity to deception and delusion. The very magic of the space colludes with the commodity promises on sale. Walter Benjamin mentions a phosphorescent effect in an

early jotting for his *Arcades Project*, his attempt to trace the ur-form of consumerism. He draws connections between a palace of optical illusion, a religious site, and places of commerce and travel:

Musée Grévin: Cabinet des Mirages. Representation of a connection between temple, railroad station, arcades and market hall where tainted (phosphorescent) meat is sold. Opera in the arcade. Catacomb in the arcade.⁵

Phosphorescence, from the Greek ‘I bring light’, is a faint luminosity, continuously emitted, not flashing. It is a phenomenon of transition and is at home in both the organic and inorganic world. It can be found in living and dead matter. Minerals may emit the greenish light after exposure to extraneous sources of light. Phosphorescence can appear during the decomposition of animal and vegetable matter. Phosphorescence is a luminous sign of decay. The mineral phosphor was used to illuminate time on clock faces. It also produced sparks from fireboxes. Phosphor appeared in all of the parallel worlds of the nineteenth century: animal, vegetable, mineral, human, technological, sparking, sparkling, dead and dying. Its gentle luminosity was just one example of the gleam that inhabited and so characterized the arcades – analogue of the *Schein* or sheen or appearance – that made the nineteenth century so spectacular and that let it seem so to exceed so glitteringly nature’s pallid beauty. For each part of nature a synthetic version was busy being found, in order to outstrip nature’s charms, or, as in the case of colour chemistry and guano, in order to make up for the deficits in imperial-national natural provision. Solar lamps replaced the sun, and the stars and the moon were swapped for Argand’s astral lamps, of whose allure Poe wrote in his *Philosophy of Furniture* of 1840:

Never was a more lovely thought than that of the astral lamp. We mean, of course, the astral lamp proper – the lamp of Argand, with its original plain ground-glass shade, and its tempered and uniform moonlight rays.⁶

Moon exchanged for lamp, night exchanged for day. Gas lamps, oil lamps, mirrors and glass, reflecting surfaces, flickering or gleaming lights – all this was at home in the arcades and contributed to the specific sheen of that place, a place of glitter. Even the shops’ names are picked out in artificial gems. And, above all, the stars have come down to earth and seem to be inside the arcades, twinkling at night through the glass roofs, as if they were the arcades’ own canopy, its own heavenly tree of stars or brocaded tapestry of spun silver silk thread. The arcades are the smallest, most private unit of habitation and the largest, most distant, most extra-intimate, at once.⁷ They appear to be a kind of microcosm. The whole cosmos is projected into them,

contained in them. This projection of spaces, a fundamental confusion of co-ordinates, in which there is a loss of orientation, a loss of knowledge of where the self is because of knowing where the sun sets, where east is, is repeated in the very glittering nature of the arcades themselves. Here there is an ambiguity of space created by the abundance of mirrors. Mirrors distort space and divert steps. Gutzkow noted, in 1842: 'The way mirrors bring the open expanse, the streets, into the café – this, too, belongs to the interweaving of spaces';⁸ adding: 'Where doors and walls are made of mirrors there is no telling outside from in. Paris is the city of mirrors.' This is what Poe disparagingly called the 'glitter upon glitter', 'a perfect farrago of discordant and displeasing effects'.

The rage for glitter – because its idea has become, as we before observed, confounded with that of magnificence in the abstract – has led us, also, to the exaggerated employment of mirrors. We line our dwellings with great British plates, and then imagine we have done a fine thing. Now the slightest thought will be sufficient to convince any one who has an eye at all, of the ill effect of numerous looking-glasses, and especially of large ones. Regarded apart from its reflection, the mirror presents a continuous, flat, colourless, unrelieved surface – a thing always and obviously unpleasant. Considered as a reflector, it is potent in producing a monstrous and odious uniformity: and the evil is here aggravated, not in merely direct proportion with the augmentation of its sources, but in a ratio constantly increasing. In fact, a room with four or five mirrors arranged at random, is, for all purposes of artistic show, a room of no shape at all. If we add to this evil, the attendant glitter upon glitter, we have a perfect farrago of discordant and displeasing effects. The veriest bumpkin, on entering an apartment so bedazzled, would be instantly aware of something wrong, although he might be altogether unable to assign a cause for his dissatisfaction. But let the same person be led into a room tastefully furnished, and he would be startled into an exclamation of pleasure and surprise.⁹

Poe assaults American décor and decorum, elaborating the errors in the philosophy of American household decoration. The 'violent' love of gas and glass is a perversion of taste. Gas casts a harsh and unsteady light. Glare is intensified in glass and mirrors. The two together, cut-glass lampshades, make an unequal, broken and painful light. The perfect room would have curtains of crimson silk, lined with silver, fringed by a deep network of gold, tied by a thick gold rope. It would have silvery wallpaper, and large paintings representing fairy grotto landscapes. It would have a single mirror, which at no point reflects the room's seated occupant. An Argand lamp 'depends from the lofty vaulted ceiling by a single slender gold chain, and throws a tranquil but magical radiance over all'.¹⁰ Poe's endeavours reintroduce a calm

enchantment into the room, a gently shimmering refuge from the chaotic glitter of the city.

The modern city disorients. Night is turned into day, inside becomes outside and duplication and duplicity abound. Mirrors reflect the light, intensifying its blinding nature. They open up spaces and eliminate boundaries. The social consciousness stimulated by flinging an awareness of continually repeated sameness into the middle-class interior destroys bourgeois fantasies of the *Privatmann*, with his individual autonomy. The same bourgeois citizens are pouring the same cups of tea from the same dinner services in the same plush dining rooms, heavy with the weight of supposedly individual traces, cases covered in monograms, mirrors to replicate an eminently replicatable scenery.¹¹ The mirror duplicates endlessly. There can be no resting point of reflection. It is the eternal return of the image. Mirrors as confusing, mirrors as distortions, mirrors as trace and dream catchers, all this trips up the doctrine that literary realists call reflection. And once the mirror image is fixed on the permanent mirror of the photograph's silvery surface the image becomes portable, which means its meanings and potential become part of memory proliferate. It effects the burst of a snatch of the past into the present, one space transported to another.

COSMOLOGY: TWINKLE AND TWINS

It had long been known that some materials darkened or faded when exposed to the sun. Silver compounds were particularly sensitive. In 1727 Johann Heinrich Schulze accidentally mixed silver with powdered chalk and nitric acid as he attempted to make phosphorus in a glass container. The window next to where he worked was open and sunlight streamed in. His white mixture darkened gradually, but only where it faced the sun. Further experiments proved that the shadowing happened more quickly if the silver content was increased. Schulze's discovery found fame as a trick of science, a parlour game. Around 1800 Thomas Wedgwood made 'sun pictures'. He placed leaves or suchlike on leather that had been treated with silver nitrate or silver chloride. These were deposited in sunlight. The exposed areas of the leather went dark and once the object was removed a white shape remained. But these whiter portions darkened too in time, even if Wedgwood soaped or varnished the leather. The fleeting images were viewed by candlelight and disappeared. But one day in the 1830s images were fixed. If mirrors throw images across space, then inside cameras, mirrors and lenses likewise throw images through space, but through their fixing and portability they also transport them across time. Cosmological telescopes had contained mirrors and reflecting lenses, and these instruments, which had sought the transportation of the image *through* space, instantly participated in a capturing *of* space. The whole cosmos and the extra-terrestrial could be projected into portable form, for contemplation in the interior. This was part of photography's

original utopian and cosmic compass. In Arago's speech to the French Chamber of Deputies in 1839, when he sought to gain state funds for Daguerreotypy, he revealed something of this utopianism. Arago was an astronomer and a politician, and had requested that Daguerre make a photograph of the moon, which Daguerre did on 2 January 1839. Astrophotography was there from the very beginnings of photography. Arago imagined its uses to come. He planned maps of the moon, photographs of stars and a record of all the Egyptian hieroglyphics.¹² Practitioners' initial sense of the scope of the invention proved early photography to be scientific, experimental and utopian in its breadth. There is an affinity between heavenly bodies and photography, those sheeny silvery surfaces, that emerge from and in light. The astronomical uses of photography persisted. In 1842 the first recognizable image of the sun was made by Noël Paymal Lerebours, followed by Leon Foucault's and Armand Fizeau's attempt in 1845, which showed sunspots. In 1842 a partial eclipse of the sun was caught, and in 1851 a daguerreotype of a total solar eclipse captured the prominences and corona in a 24-second exposure. John William Draper achieved a daguerreotype of the moon in 1840 after a 20-minute exposure, but this was a difficult image to catch, given planetary mobility and moonlight's weakness. Wet-collodium processes had a greater light sensitivity, and Warren de la Rue used them in 1852 to capture the moon. Lewis Rutherford got his moon and it was named after him. His pictures of the moon's surface with highly visible shadows were shown at the Société Française de Photographie in 1865. These attempts of men to catch the moon were something like the child's learning to grasp, a definition of utopia devised by Benjamin in a version of his essay on age in the age of its technical reproducibility:

Just as a child, when it learns to grasp, stretches its hand out to the moon as if after a ball, so too humanity in its attempts at innervation, alongside that which is graspable, sets its eyes on tasks which are at that moment utopian.¹³

In Benjamin's *Arcades Project*, this same image appears in relation to revolutionary utopian politics:

Fourier's conception of the propagation of the phalansteries through 'explosions' may be compared to two articles of my 'politics': the idea of revolution as an innervation of the technical organs of the collective (analogy with the child learns to grasp by trying to get hold of the moon) and the idea of the 'cracking open of natural teleology'.¹⁴

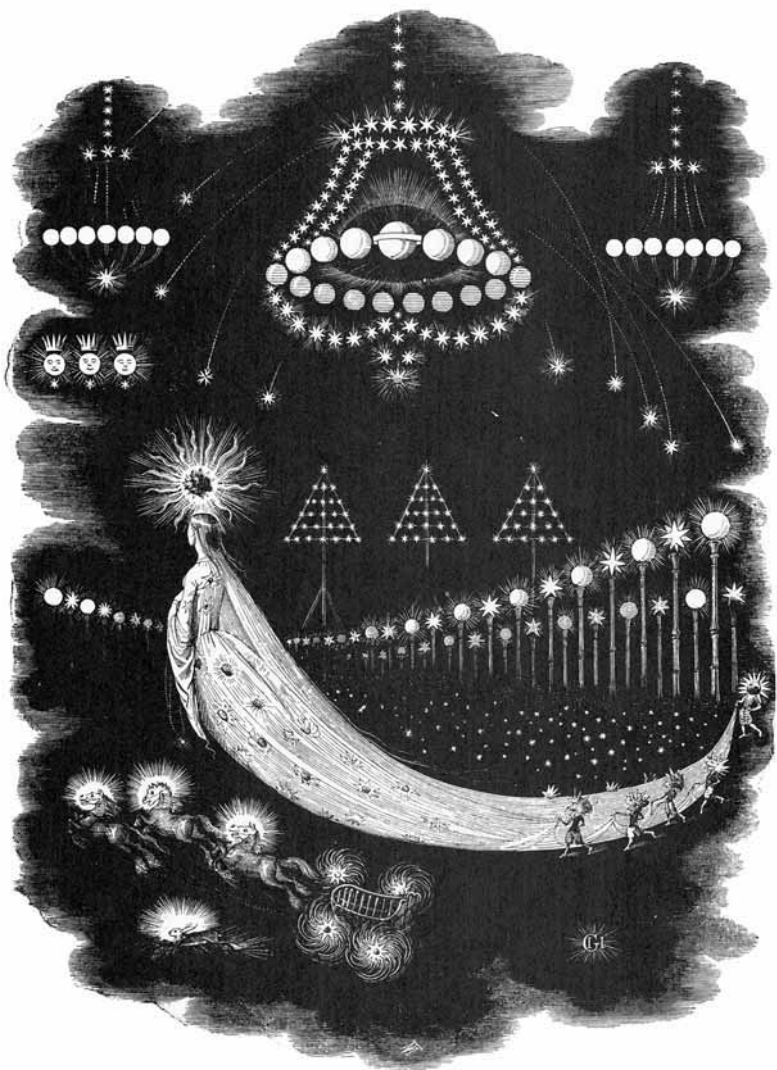
The human collective acts like a child with a utopian urge to grab the moon, because it seems so close. In making such efforts, the collective acts

against nature's apparent laws, opening itself up to technological developments that might indeed make the moon graspable, in one way or another, even if only on photographic papers or through space travel. Was utopia revealing itself as an achievable goal in this epoch of industrial and technological change? Something had changed, perhaps, since Robert Boyle's more pessimistic vision in the essay 'Upon a Child that Cri'd for the Stars'. Boyle was a mechanical philosopher, although his 'corpuscularianism' included chemical causes and 'cosmical qualities'. His mechanical view of the universe was consistent with his belief that God's omniscience transcended the narrow compass of human reason. 'Upon a Child that Cri'd for the Stars' notes how a child is fond of gazing at the 'twinkling Lights' of the night sky. It delights in the twinkling spangles, but, because it is seized by an irrational and impossible desire to grasp these baubles in its hand, its pleasure is spoiled.

But his is a pleasure, that is not more great than unquiet, for it makes him querulous, and unruly, and because he cannot by his struggling, and reaching forth his little hands, get possession of these shining Spangles, that look so finely, their fires produce water in his eyes, and cries in his mouth, that are very little of kin to the Musick the Platonists fanci'd in the Spheres he looks at. Whereas, though my inclinations for Astronomy make me so diligent a Gazer on the Stars, that in spite of my great Obnoxiousness to the inclemency of the nocturnal air, I gladly spend the coldest hours of the night in contemplating them; I can yet look upon these bright Ornaments of Heaven it self, with a mind as calm and serene, as those very nights that are fittest to observe them in.¹⁵

This child, insists Boyle, is like those men who are of too amorous a disposition and whose heart pays dearly for the eye's pleasure. Boyle defends a rational science that accepts the religious cast of mind. Reason and religion, components of a sober mind, can 'look upon the same Objects with pleas'd but not with dazzl'd eyes', for it knows there to be a greater construction and this twinkling is but 'a faint shadow of the Divine Artificer'. Convinced of that, the 'rational contentment of the Astronomer' is a more lasting if 'less transporting' pleasure than the 'unquiet pleasure of the Child'.¹⁶ Boyle's astronomer casts his mechanistic glare on the wondrous bejewelled inky heavens, and the child delights and rails at the sparkly lights. A utopian tradition sided with the child's impetuous fancies, and believed emergent science to be its ally.

A twinkle: an intermittent or transient shining, a sparkle, an inkling, faint but perceptible, a wink, a flicker, a spangle, a shimmer, a scintillation, a soft or momentary gleam or glimmer, a glittery flash, then disappearing to darkness, only to immediately return to glint once more. On / off, on / off. Twinkling is a barely perceptible presence and absence. Inside the word



Grandville's artificial utopia: 'The passage of a comet across the sky', from *Un Autre Monde* (Paris, 1844).

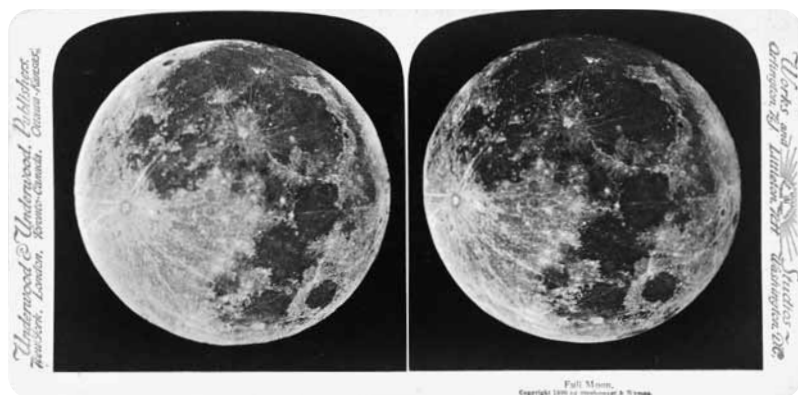
twinkle is the word wink, and it conjures up blink too. These are small movements, but significant ones, the knowing wink, the blink of an eye. Twinkle, twinkle. The word twinkle does itself what it describes, that is to say, it sounds as it is: twinkle, on / off, twin-kle, two syllables of differing sound quality. Twinkle is visual onomatopoeia. Light's fluctuation is there, then not there, and if repeated, as in the nursery rhyme, 'Twinkle Twinkle Little Star',¹⁷ then the effect on the ears is the same as the effect on the eyes. It is there, and

then not there, there again, not there. The lullaby of twinkle called *Twinkle Twinkle Little Star* concerns the identity between us and the stars, or at least an affinity that comes to us these days only in the most debased version of astrology. 'Twinkle Twinkle Little Star' assumes an affinity between star, child and mother. We look at the star and our stare is matched reciprocally. It looks at us. It looks over us, peeping through the curtain, guiding the traveller, making vision possible by the light cast of its glitter. The seemingly tiny thing so far away sends its light to us, so we may return our gaze. The twinkle is an illusion. Stars do not twinkle for themselves, but for us. Stellar scintillation appears to our eyes because, viewing stars from the earth's surface, we see them through thick layers of turbulent air on the move in the earth's atmosphere. Each layer has a different temperature and density. As the star's light beams through the atmosphere, the layers bend it, refracting the light in different directions. This bending, perceived as a kind of jumping from side to side, arrives in our eyes as a twinkling. Stars do not twinkle if viewed from outer space or from a planet or moon that has no atmosphere. This twinkle is a historical product of our atmosphere. It makes the 'little' stars a thing for us. And this they became all the more so once the German-British astronomer William Herschel discovered by telescope the planet Uranus in 1782. Herschel also made the first attempts to measure the distances to the stars and showed that the earth received invisible energy from the sky. He produced the first map of our galaxy. And this world up above owed much to the world down below, for the vocabulary he developed of stellar 'strata' and the 'bed of stars' drew on the new language of contemporary geology. 'Twinkle Twinkle Little Star' notes also a particular affinity between star and mother, who seemingly never shuts her eyes, and guides the child's way through life. The words for 'Twinkle Twinkle Little Star' come from a poem called 'The Star', written by Ann Taylor and her sister Jane, and first published in 1806 in a collection called *Rhymes for the Nursery*. Such a book for children was a luxury item at that date. Any mother who read from it would in all likelihood have been a well-heeled lady. She might have worn about her person, by her heart, the diamond referred to in the line 'Like a diamond in the sky', further reinforcing her identity with the stars up above. Her continual presence through the night, just like the star, is, however, an illusion, of course, sustained by the child's slipping into sleep, into unconsciousness, its eyes shut, its own dreams now plotting a vivid and illuminated path through the inky night. The relationship between the mother and the diamond is circuited through money's capacity to buy natural rarity. 'Like a diamond in the sky': here one natural object substitutes for another, one vast and more or less unknowable, the other small enough to grasp in the hand. Diamond, the hardest known natural substance, is pure carbon. It is crystallized at high pressure and temperature hundreds of kilometres inside the earth. Erupted volcanoes sometimes fling multi-million-year-old diamond-filled magma rocks to the surface, which harden and from which diamonds can be extracted.

Occasionally alluvial mining could throw up the odd beauty, sifted from infinite gravel, sand and mud. Once diamonds were found in South Africa in the 1860s, open-cast and underground mines were dug deeper and deeper and colonial masters seized the land. The brilliance of the diamond in the hand is muddied by blood and sweat as it is dragged up out of rocks and mines or sifted for too long on riverbeds on the colonized side of the world. The star in the sky is there for all. No one owns that natural form. The diamonds in South Africa are natural too, but as hard-won and beautiful objects they enter the world of luxury and commerce, to be owned by those who never mine them. In 'The Star', the stars are analogous to the ultimate commodity. The untouchable, desirable stars become potentially graspable and an object of possession in the shape of a diamond. This glistening sky-gem of nature is degraded into a luxury item; the star becomes a diamond; the diamond, as a result of a social-economic process, becomes a commodity. The diamond becomes commodity, loved, above all, for its exchange value and not for its beauty. Once this has happened, the relationship between diamond and human is altered, filtered through the mediation of a social process. Wrenched from the natural world, it becomes a social product.

Marx wrote of pearls and diamonds in an effort to specify the illusions of the capitalist system. Misled by the fetishism of commodities, bourgeois economists assume that the exchange value of pearls and diamonds is inherent in them as natural objects. In the topsy-turvy economist's view, this exchange value is like a 'chemical element', even though 'so far no chemist has ever discovered exchange-value either in a pearl or a diamond'.¹⁸ But, insists Marx, exchange value has nothing to do with the pearl or diamond as natural object, being a 'social manner of expressing the amount of labour bestowed upon an object'.¹⁹ Elsewhere the diamond serves as an illustration of Marx's notion of commodity value as based on the socially necessary amount of labour required for its production. As material thing it is useful, and this is independent from the amount of labour needed to 'appropriate its useful qualities'. Diamonds are rare. To discover them costs much labour time. Perhaps diamonds never achieve their actual value, for other more available commodities realize much more money compared to the amount of effort invested. As Marx notes, 'If we could succeed at a small expenditure of labour, in converting carbon into diamonds, their value might fall below that of bricks'.²⁰ Such a process was yet to come, but the diamond-stars could come down to earth and be captured on photographic plates. The jewels of heaven that represented another inaccessible but desirable world were brought down to earth. All could be grasped, held in the hand, gazed at in the privacy of the parlour.

Along with the sun and the moon, the stars were captured, from 1850, and, from the 1880s, the Milky Way, the spiral nebulae were caught photographically. The moon, the stars, the sun, the planets are visible in a book, as



A widely reproduced stereoscope image of the full moon, c. 1899.

if through a telescope. The camera had replaced the seeing eye as a light detector. It was a new type of eye, as M. Biot had noted, during Daguerre's speech in 1839, expressing his admiration for the invention, which he could justly praise only by comparing it to a kind of physical retina as sensible as the retina of the eye.²¹ But this was an improved eye, able to collate light over long periods (over hours or nights), thereby allowing observations to go to the dimmest areas. Plans were made to map the whole sky. As astrophotography advanced, vast numbers of faint stars found on more sensitive plates suggested a photographic atlas of the sky. The most ambitious atlas was begun in the 1880s in the *Carte du Ciel*, launched by Mouchez at the International Congress of 1887 and based at the Paris Observatory but embracing observatories worldwide. It is impossible to complete. Around 1880 gelatine-silver bromide plates, which were more light-sensitive, allowed for great advances in astronomical photography. Heavenly bodies, stars, galaxies, visible only by virtue of their emission of light, beyond the capacity of human eye, came into view, and the universe was no longer defined by the limits of human vision.

The stars caught on photographic paper are visible through the glass roofs of the arcades, but the arcades are by now on the point of disappearance, and with them too the stars. The paradise they pledge is on the point of extinction. The stars are traditionally pointers to a universe of destiny, without human volition. Louis-Auguste Blanqui's melancholic treatise, penned while incarcerated for his activities during the Paris Commune of 1871, was called 'Eternité par les Astres'. In it the stars are the markers of that fate of ours, to be locked in eternal recurrence, denying historical movement. Blanqui turns the cosmos into an abyss. His treatise is an anti-utopia. The stars, nature, trap us in eternal return. Nature is victorious over history, and this is disastrous for human utopias. Similarly Baudelaire's abyss of the world is starless.²² Walter Benjamin notes the absence of stars in Baudelaire's

‘Crépuscule du soir’. This banishment of the stars, he claims, was part of a refusal of appearances, a *Scheinlosigkeit*.²³ Baudelaire renounces ‘the magic of distance’ in his dystopia.²⁴ Those romantic chinks of lights have no place in the debased world of modernity. The stars that remain are only ‘the picture puzzles of commodities’, the ‘always again the same in vast quantities.’²⁵ Perhaps the stars are evacuated because their shine has transferred to the commodity. Benjamin notes: ‘With the new production processes, which produce imitations, appearance [*Schein*] is crystallised in the commodities.’²⁶

The stars are banished in Baudelaire. It is as if he recognizes that the stars no longer guide the way in the modern cosmos, not simply because they are technologically surpassed by lamps and scientific instruments, but also because they are increasingly unable to appear amidst the light pollution that began to gather in his time. In 1806, when Jane and Ann Taylor wrote ‘The Star’, the light and scintillation of the stars were intense. By 1879, when Thomas Edison put into commercial circulation the carbon filament light, the death of night-time began. By the time that thousands and thousands of copies of *Rhymes for the Nursery* had been sold in 1881, after multiple editions, its twinkling star was fading.²⁷ Artificial light abolishes twilight and ‘stars disappear from the sky over the metropolis’.²⁸ Benjamin records the decay of the glassy dream-houses under a new illumination:

So long as the gas lamps, even the oil lamps were burning in them, the arcades were fairy palaces. But if we want to think of them at the height of their magic, we must call to mind the Passage des Panoramas around 1870: on one side there was gas light; on the other oil lamps still flickered. The decline sets in with electric lighting. Finally however it was no decline but, properly speaking, a reversal. As mutineers, after plotting for days on end, take possession of a fortified site, so the commodity by a lightning stroke seized power over the arcades. Only then came the epoch of commercial firms and figures. The inner radiance of the arcades faded with the blaze of electric lights and withdrew into their names. But their name was now like a filter which let through only the most intimate, the bitter essence of what had been.²⁹

Commodities displayed under constant electrical glare, a modern over-exposure of the new, leaving only the poetry of brand names and commodity promises. ‘At the height of their magic’: the charm generated by the shimmering appearances is an indicator, a transfer of the potential the wider society gestates. As Eugène Buret put it in 1840, in his study of the misery of the working classes in France and England:

The most fantastical creations of fairyland are near to being realised before our very eyes . . . Each day our factories turn out wonders as great as those produced by Doctor Faustus with his book of magic.³⁰

Our factories turn these wonders out, or rather the workers do, transforming the world, remaking the world, exhausting, consuming and replacing nature's riches. Here was so much ruination, ruined hopes, ruined bodies, ruined nature. Even the sky is ruined. Anti-twinkle in the shape of dust and clutter, physical analogue of a certain impotency to alter for the better the most important things, blotted out cosmic dreams. But truly, too, the cumulative electric light of lampposts and 24-hour factories and office blocks evacuate the stars from the cityscape. The scintillating twinkle, produced by irregularities in the density, humidity and temperature of the ambient atmosphere that refract and make dance the photons, and which emerge from either a humid or a human-technological climate, is eventually blocked by that same human-technological climate as it produces electric-light pollution, misting up the vistas, voiding the heavens.

But artificial light was opening up other visible worlds of knowledge. In the 1860s Nadar photographed the subterranean world under Paris, catching it in the flash of electricity, although his exposures were not quick enough to catch fleshly reality in the catacombs. In order to capture a sense of scale, he put life-size mannequins in the camera's view, rather than humans, because of the stillness necessary, 'the absolute inorganic immobility'.³¹ It was not an animated twinkling down there in chthonic Paris, where Nadar descended into the depths, into the underworld, in order to find a lost image, the image of happiness. It was deadliness caught electrically, where arrest and stasis are the motifs of developing photography.

The stars had come down to earth. They had been merged with the diamonds torn from the belly of the earth. Those diamonds had become markers of value, appreciated less for their beauty than for their worth. Exchange value had come to prominence and with it a glamour and glimmer that attached to objects, a faked aura that was the bounced light of their metallic equivalent, the price ticket. These earthly stars, the gems of commerce, found glorious setting in the arcades, an early home of the commodity in cities organized around delightful looking. Photography emerged as the arcades declined. The artificial capture of the stars, the moon, the sun made nature 'for us' and prompted fantasies of utopian science and new modes of living.

GLASS SOCIETY

The arcades were the first homes of the commodities. In the process of commodification, wish-images, fragments of utopian potential, promised in the first flirtatious kisses of modern industrialism, congealed into fetish. Their pledges existed only as vestiges. The arcades fell into decline. The dream-infested commodities found other homes. Iron and glass architecture found other forms – winter gardens, railway stations – until glass was abandoned and metal alone embraced. The hangar, the Eiffel Tower, the Pont Transbordeur in Marseilles were some of the forms that evolved from the

first efforts in metal construction in the arcades. Modernity was curled up in those forms like Goethe's *Urphenomena*, all its stages, including its future, contained in its original form. The future is contained in the past. Like a magic mirror, it waits to reveal itself in the present, to come into legibility. All that confusion and disorientation by reflecting glass and mirrors turns into legible, modern, industrial spaces.

But glass was still loved, especially by utopian architects. Le Corbusier's watchword was transparency.³² Others adhered to this. For example, Peter Behrens, Walter Gropius and Adolf Meyer designed factories of glass out of an enthusiasm for transparency in modern social relations. Glass, no longer disorienting in the form of mirrors, but see-through, see-throughable, is the material that banishes confusion. Glass promises to be an 'enemy of possession'.³³ Glass does not allow secrets. It makes public. New forms of living were incubated under glass. The fantasist Paul Scheerbart wrote a book on glass architecture in 1914, another contribution to ideas about glass culture as a form full of revolutionary potential for modes of everyday life. In 1914, as an architectural form, its extended use was still as utopian as Fourier's crystal-palace-like phalansteries. It would not have survived the aerial bombs to come (despite Scheerbart's fantastical claims that it was better suited to a militaristic age, for, in war, the frames would buckle and glass panes would shatter, but it could be easily repaired and, unlike brick architecture, it would not tumble, killing passers-by).³⁴

In 1849 Gobard imagined, in his 'Architecture of the Future', a structure full of apertures, which would make a 'diaphanous' housing, its 'wide openings, furnished with thick glass, single- or double-paned, frosted or transparent', transmitting 'to the inside during the day and to the outside at night – a magical radiance'.³⁵ This radiance Scheerbart sought too, but he also made glass the purveyor of a new morality, mirroring Fourier perhaps in the intermingling of cosmic concerns and utopian scientific reflections on glassy constructions. Window glass is see-through. It is crystal, a pure prism. Its crystalline character stands for absolute form, the perfection and completeness of materials. Its fragility becomes a moral trait: it breaks (rather than bending like metal or other substances). It is the contrary of stone and brick. Those two are like tough coatings, impenetrable, blocking – like a shell or armour, keeping the world out. For Scheerbart glass transforms into a type of sensitive membrane, like the retina of the eye: that which is looked through, the window, becomes the very mechanism of looking, the eye. Human and object share an identity. It is as if in the imagining of a perfect future world there should be no difference between the structures we inhabit and ourselves. This is the bringing into alignment of humans and technologies that utopia so often vaunts, and its implication is that the exploitation of nature, including ourselves as nature, is over.

In *Glass Architecture* Scheerbart wrote of a transparency that would let in the light of the sun, the moon and the stars. It would allow empathy with

nature, but even better and more strikingly, it would give out its own brilliant and electric light into the night. The earth's surface would be transformed, he wrote in the chapter called 'The beauty of the earth once glass architecture is everywhere'.

The surface of the earth would change immensely if everywhere brick architecture were replaced by glass architecture.

It would be as if the earth had clothed itself in jewellery of diamonds and enamel.

The magnificence cannot be imagined.

And then we would have all over the earth things much more luscious than the gardens in *A Thousand and One Nights*.

We would have a paradise on earth and would no longer need to gaze longingly at the paradise in the heavens.³⁶

This is an aesthetics of appearance, all twinkling surfaces, the play of light and reflection, a fairy-scape. The glass that Scheerbart imagines everywhere is both crystal clear and coloured. Glass walls of all colours would be placed inside glass houses with glass doors that were automatic. There would be glass walls in the parks too, making the space of the park constantly variable.³⁷ Glass fibres would make sheets and covers and all sorts of usable things. The presence of glass would make nature look different, for it would stream a coloured, warmer light.³⁸ Floodlights would be placed in parks to make night more beautiful than day and its beauty would outdo the night sky, which is anyway clouded over by electrical pollution. The darkness would be transformed. Glass factories, crystal palaces, glass homes and railway stations would twinkle in the night. The scene will be especially beautiful for travellers in airships, a mode of transport now possible because of the increased illumination. The inhabitants of Venus and Mars will be amazed by the displays, and astronomers will have to descend into mine shafts and climb hills to observe the sky because there will be so much electric light.³⁹ By installing mobile mirror planes the floodlights would cast all sorts of colours into the sky.⁴⁰ By turning hotels into glass hotels, Scheerbart imagines the illumination of the mountains.⁴¹ Glass architecture will be so beautiful that desire itself will be quelled. We would no longer travel because our longing for something different would be satiated, although new glass wonders might tempt us sometimes.⁴² Glass architecture would bring about the loss of some industries, but the winners, notes Scheerbart, would be heavy industry, the chemical colours industry and the glass industry.⁴³ Technological development has almost made possible a new mode of living, a new beauty and a certain reframing of the natural world. This is a utopia indeed, but one that might teeter on realization.

Scheerbart had imagined even more than this in his fantastical novellas. *Münchhausen und Clarissa*, of 1906, collates a number of tales, and the

narrator is the infamous liar Baron Münchhausen, whose stories had been related and embellished since the late eighteenth century. The baron describes his adventures during a seven-day sojourn in Melbourne. One story tells of how the delights dreamt of in the Grimm brothers' stories pale beside the journey into the centre of the earth in a luxury vehicle. Stones, gems, metals, colours, caves, rocks, vistas, mist and smoke are all on view.⁴⁴ At a restaurant, glass walls separate the viewers from animals similar to whales and jellyfish in aquariums 7,000 metres beneath the sea. Münchhausen reports on a world exposition in Melbourne. The exhibition buildings are outlandish: 30 giant towers and a central tower of 150 floors, connected by bridges and up and down the towers and over these bridges cross the rooms like lifts and vehicles, while the towers turn. The whole is a turntable architecture. In Scheerbart's mobile architecture, it is possible to sit on a comfortable armchair and gaze through the window, while traversing the entire exhibition, observing how the moving buildings click into new shapes like a 'slowly moving kaleidoscope'.⁴⁵ An indescribable wealth of lineal and plane compositions, of vistas and perspectives, opens up to the visitor.⁴⁶ The panorama through the window changes gradually: fountains spume from the lake, vast islands approach, as do palaces and parks and towers and streets. Once night falls a light architecture sparkles in the dark. There are more electric lights than a telescope can capture in the night sky. Countless multi-coloured electric stars are caught in the crossbeams of coloured floodlights, which seem like giant comets, and this entire brilliant flickering rotates.⁴⁷ Scheerbart saw his own writing as kaleidoscopic, always changing, always provisional. He compared it to an opal, where always new facets of colour come to light. In *Münchhausen und Clarissa* the Baron tells his stories about Melbourne, in no particular order. Likewise in the novel *Immer mutig!* (1902) the narrator Scheerbart is lost in the mountains, when a mountain opens up to reveal a miniature hippopotamus, who draws him into a room inside. There, in response to demands for various types of story, Scheerbart as storyteller reads 83 pieces from the manuscript that he always carried in his bag. Nothing holds the stories together as one. There are dreams, curiosities, fairy-tales, jokes, tales of misfortune and paeans to ink, the very medium of composition, and its arbitrary by-product, inkblots. All this amounts to a kind of aperspectival multilayering, and frequently the hippopotamus and the rest of the audience, all ancient Egyptians, add their perspective, their objections and their wishes. Hope and potential might inhabit such a cosmos. The book ends with a momentary glimpse of the 'inexhaustible riches of the world'.⁴⁸ In 1922 or 1923 Benjamin jots some notes on *Münchhausen und Clarissa*. He quotes a passage on how in the nineteenth century so many things were turned inside out, but people were not turned inside out and so they no longer fitted. Münchhausen came to perform this refitting task. The book represents a 'utopia of the body' and this is related to the 'eccentric rebellion' against the body's 'convention'. In

this utopia the body might become something different – for example, this bodily utopia is one in which movement comes to the body without its making an effort. The utopian body is enhanced by technology or by a fantastical reimagining of possibility. The book also causes Benjamin to remark that the ‘earth forms a body in conjunction with humanity’, and so the earth lives.⁴⁹ This is the core of Scheerbart’s utopian vision. Humanity is put in tune with its technologies. This necessitates rejecting ‘exploitation’ of nature. Technology, in liberating humans, liberates everything.⁵⁰

In the years after the First World War Bruno Taut dreamt up crystal buildings too, such as crystalline community halls and steel and glass pavilions, and his plans placed glass cathedrals in the mountains or on the stars. Such utopian schemes rarely translated into reality. Mies van der Rohe’s glass fantasies got closer. In the early 1920s he proposed two glass skyscrapers: a glass tower and a building on Berlin’s Friedrichstrasse composed of three glass columns and crystalline in form, its glass plates faceted and designed to jut into the Berlin cityscape, reflecting back prismatically the city’s gleam. For these crystal towers Mies intended a steel structure that was the building’s bone, which freed the exterior walls from their load-bearing function. Its glass surface was a skin. The skin let the skeleton be seen. The building is a body. That which we inhabit is like us. The surface of the building was translucent and, in some sense, inessential. The inside should let the outside in and the outside should be reflected into the interior, such that life might be everywhere apparent. The buildings were not built, though others were. But those that found reality were not designed for the collective to exist in a techno-world that enables the human body to experience more, and to be exposed to beauty.

Walter Benjamin noted ruefully, at the end of his short study of Scheerbart, written for a French journal in the late 1930s, that Scheerbart’s beloved glass architecture was prohibited as subversive in his own country.⁵¹ It found some sort of end in Crystal Night, the pogrom against the Jews in the cities, a vicious revelry of glass smashing. Glass’s transparency had most prominently been put to the service of the commodity in the 1920s and ’30s. It enabled commodities to advertise themselves under illumination at all times in the new, sometimes Jewish-owned department stores. Confused thugs shattered these windows, in the deluded thought that they might get their hands on the goods if the Jews were gone.⁵² Instead of glass, a new old architecture appeared. Stony monumentalism was the order of the day in a fascist architecture of power built for eternity and modelled on past empires.⁵³ Fragile, transparent glass slipped back into the fantasy world, such as that dreamt up by André Breton in *Nadja*, in 1928:

For my part, I shall continue to live in my house of glass where you can always see who comes to pay a visit, where everything suspended from the ceiling and on the walls holds where it is as if by magic, where I

sleep at night in a bed of glass, underneath sheets of glass, where *who I am* sooner or later appears to me as etched by a diamond.⁵⁴

In this Surrealist statement, with its dreamy imagery, the wish for a transparency of relationships can be discerned, but perhaps not realized at this moment. It is not just transparency that is desired, for that would be too unambiguous. Even the self is unknown and will be delineated by a piece of carbon, a diamond, which is no different in appearance to the sheets, the bed and the writer himself, who is sketched presumably as faceted outlines. For Breton, Surrealism always seeks a point of indifference, where the contradictions of convention seen from another point of view no longer matter, for all that matters is matter, the self returned to a primitive carbon state. Breton reflected on this in the 'Second Manifesto of Surrealism' in 1930. Surrealism sought a point at which all contradictions – life and death, the real and the imagined, past and future, the communicable and the incommunicable, high and low, construction and destruction – no longer feature as differences. What was the goal of Surrealism? The pursuit of 'the annihilation of the being into a diamond, all blind and interior, which is no more the soul of ice than that of fire'.⁵⁵ The self is returned to its mineral state, before the contradictions that produce differentiation. Romantics and Surrealists sought an identity with objects in the world. Individuality is quashed in Breton's vision of the self as carbon, a mineral state prior to consciousness, but this is not pessimistic nihilism. It is a return to beginnings and the recognition of old relationships.

DREAMS AND THE FUTURE: ON METHOD

Walter Benjamin adapted Surrealist methods for his study of the nineteenth century. His watchword was: discover the collective dreams that were incubated in the accumulation of objects, products, matter, processes and practices. In Benjamin's *Arcades Project* the nineteenth century is imaged as containing fantastic potential bound up in objects, in image technologies, such as optical toys or photography. The fantastic potential is also present in nineteenth-century wish images, dream images, phantasmagoria, social movements and utopias. Benjamin is in search of these social dreams. He does not tell history in any conventional sense, but rather performs a type of dream analysis. One of many comments to this effect explains the wish: 'To go through what has been with the intensity of a dream, in order to experience the present as the waking world to which the dream refers.'⁵⁶

Benjamin frequently recorded his own dreams. In 1932 one dream was called 'The Knower' and it took place in Wertheim's department store.⁵⁷ Benjamin is observing wooden figures. These are little animals that might fit into a toy Noah's Ark. The toys are made from magic plates and ribbons that change colour. Benjamin enquires as to the price and finds it to be more than 7 marks. The high cost surprises him. As he turns away he notices how the

toy's construction changes. He glimpses a mirror on the toy and this mirror allows him to see into the toy's interior. There is a street and children are playing. The street is covered by glass, and the children and houses are colourful. He cannot resist buying this toy now, and longs to show it to his friends that evening. However, there are riots in Berlin and the cafés offer no protection. So he leaves, with friends, for the desert where it is night, and lions prowl. He longs to show off his toy, but everyone is too gripped by Africa. And he wakes up before he is able to relay the insight about the toy that had come to him. The toy has three parts: the street with the children, a weave of tiny wheels and cylinders and transmissions all made of wood, and finally a vision of the new order in Soviet Russia. What can this mean but that the dream presents a model for the blocked and yet now legible potential of the arcades (or the glass buildings imagined by Fourier and Scheerbart and planned by Bruno Taut, Mies van der Rohe and Le Corbusier – streets covered by glass, transparent spaces of new modern lives). It is the constructivist modernity of the Soviet Union, promising industrial modernity's egalitarian urban spaces, with truly democratic transportation, passage, communication. Inside the arcades is a transparent, revolutionary, future form, now only a dream, a potential to unfurl.

The arcades were a receptacle for the dreams of the nineteenth-century masses and their masters. The arcade houses a collective body, who wears it like an exoskeleton. The dreaming collective sinks down into the arcades, and this is compared to the sleeper who receives messages from his inner bodily processes, noises, blood pressure, muscle sensation, which are translated and elucidated in dream pictures or illusions.⁵⁸ The arcades, Benjamin tells us, are fluid places, like aquariums, doused in a greenish, spangly light. There things strike us 'like realities in the dream', 'dissolved in constant flux'. Something new always supervenes. Meaning is remoulded, montage-like, by what comes after. Revelation is delayed till waking.⁵⁹ A dream logic then is the most we might expect from Benjamin's bundle of notes and fragments and images. This is appropriate enough, for the dream, in Benjamin's view, is an index of freedom: our social dreams indicate our social utopias. The notes and quotations in the *Arcades Project* were collected from 1927 onwards. Benjamin organized hundreds of index cards on which he transcribed quotations and notations into files. He developed a system of cross-referencing, such that the cards comprised a vast array of interlinked scraps. This was no book. It was more like Scheerbart's flexible architecture of a text. This was not a pile of mirror or glass shards, or fragments that pile up indiscriminately. These fragments were set in constellation. The word constellation is recurrent in Benjamin. It appears in methodological statements such as in thesis xvii in 'Theses on the Philosophy of History':

Thinking involves not only the flow of thoughts, but their arrest as well, where thinking suddenly stops in a constellation pregnant with

tensions, it gives that constellation a shock, by which it crystallises into a monad.

Or:

In a materialist study epic continuity is abandoned in favour of constructive conclusiveness. Marx recognized that 'the history' of capital is represented only as the steely, widespanned scaffold of theory. It grasps the constellation into which his own epoch has entered with quite specific earlier moments of history. It contains a concept of the present as the now-time, in which are exploded splinters of messianic time.⁶⁰

Constellations are patterns of stars. The important aspect to a constellation is that the particular configuration of stars exudes a sway, as recorded in myth or in assertions of astrological influence. Benjamin had an interest in astrology. Around 1932 he wrote a fragment on it, attempting to defend astrology on materialist grounds. This note on astrology is akin to those jottings of his on similarity and mimetic impulse. He speaks of a 'cosmos of similarity' in which we observe resemblances between people's faces, in architecture, plant forms, clouds and skin diseases, all results equally of chance and the fact of 'an active, mimetic force working expressly inside things'. This mimetic sense is banished in time from some areas, but intensified in others. Astrology, the analysis of the influence of starry configurations, is a lost form, though, Benjamin noted in 1932:

A modern person can be touched by a pale shadow of this on southern moonlit nights in which he feels, alive within himself, mimetic forces that he had thought long since dead while nature, which possesses them all, transforms itself to resemble the moon. Nevertheless, these rare moments furnish no conception of the nascent promises that lay in the constellations of the stars.⁶¹

Those nascent promises lie there but are now dormant. The *Arcades Project*, through its themes and methodology, is also an effort to re-enliven proto-promises latent in the 'dreamsleep of capitalism'. Astrology is a type of influence at a distance. Influence at a distance, like the influence of the moon on bodies of water, pervades Benjamin's project. One of these modes of influence at a distance is influence exerted across time, a notion at the centre of Benjamin's progress-critical methodology. As Benjamin notes in the convolute 'Dream City and Dream House, Dreams of the Future . . . Jung', everything that is a part of the past can acquire in the present a higher grade of 'actuality', relevance, significance, than it had at the moment of its existing. The 'explosive materials' that are 'latent in what has been' can be brought

to ignition in the present, under a political gaze.⁶² The past has to be snatched into a moment of legibility in the present, through constellation, through the generation of dialectical imagery, moments of awakening, moments of interpretation. Benjamin frequently uses cartographic metaphors, as well as ideas of orientation, setting sails, finding paths through, when he details his method. If all of the 30 colourful hieroglyphs Benjamin used to tag his jottings are set out on one page, as Benjamin did do in a diagram, and grouped in their diagrammatic connections, what appears is nothing so much as a *Sternbild*, a map of the stars.⁶³ As Benjamin wrote to Gretel Adorno in 1935,

The dialectical image does not replicate the dream – I never intended to suggest such a thing. Rather it seems to me that it contains the instants, the points when waking up breaks in, and from these points composes a figure like a map of the stars made of glowing points.⁶⁴

The stars that no longer guide the way, or that have been obscured by the earth's over-production of illumination, have been recaptured for the purposes of orientation through and out of a brutal history of dreams turned nightmarish. In the same convolute Benjamin writes: 'As long as there is still one beggar around, there will still be myth.'⁶⁵ The tramp is still in the Underground, watching, the jeweller's window reflecting him, the watch still out of his grasp. His is a utopian myth. It attempts to escape commodity exchange, flouts desire for the possession of the commodity, blocks commodity fetishism's substitution of human lively labour for the commodity's over-animated presence. Instead of wanting to have the object, it would rather be the object, in a utopian protest against separation. Rather than commodity fetishism's myth of a relationship between things, and rather than bourgeois humanism's myth of a relationship between individuals, this myth proposes the elision of differences, a world of sympathy, of analogy, of genuine exchange. It is Benjamin's myth too, a utopian refusal of separations in the world, a pronounced 'sense of the universal equality of all things'.⁶⁶

The 'utopias of the body' animated science somewhere still. Benjamin had seen the extra-terrestrial narrowcast into the arcades, where all the contents of the world are piled up fantastically beneath the stars. From another perspective, the arcades are broadcast into the stars, in a universe now with galaxies beyond our own and expanding, since Hubble's telescopic observations in 1923 of Andromeda, a spectacular spiral nebulae in the northern sky. Hubble photographed something that was a million light years beyond our galaxy, proving thereby Herschel's speculation of 1785. Through a lens the size of an eye, the whole universe could be spied. The universe is projected into our bodies, into our eyes, our minds. We contain the universe in ourselves. The smallest and most interior is annexed to the largest and vastly exterior and each is found in the other. Niels Bohr

claimed in 1913 that electrons moved orbitally around the nucleus of an atom much as the planets circle the sun. Eddington suggested that the size of the universe might determine the size of an atom.⁶⁷ And the stars are our siblings. So claims the theory of nucleosynthesis, which contends that humans are a by-product of stellar fission. As Harlow Shapley put it in January 1925, we 'are made out of the same materials that constitute the stars'.⁶⁸ And again in a *New York Times* magazine article, under the headline 'The Star Stuff that is Man', Shapley reveals:

We are made of the same stuff as the stars, so when we study astronomy we are in a way only investigating our remote ancestry and our place in the universe of star stuff. Our very bodies consist of the same chemical elements found in the most distant nebulae.⁶⁹

In an article on Scheerbart of the late 1930s, Benjamin noted how Scheerbart's great discovery was that the stars could be used to plead the cause of creation before an audience of humans. This was a sign of Scheerbart's lack of sentimentality. Earth is another heavenly body, among heavenly bodies. It was for this reason that Scheerbart refused to accept the term world war. The world was bigger than our earth, and there could be hope in the stars. Enthusiastically Benjamin recalled, in a free rendition, a statement of Scheerbart's from 1914 in response to the outbreak of the First World War:

Let me protest first against the expression 'world war'. I am sure that no heavenly body, however near, will involve itself in the affair in which we are embroiled. Everything leads me to believe that deep peace still reigns in interstellar space.⁷⁰

Scheerbart's hope lay in the extra-terrestrial realm. His science-fiction fantasies, as Benjamin noted in 'Experience and Poverty' in 1933, had enquired into 'how our telescopes, our airplanes, our rockets can transform human beings as they have been up to now into completely new, lovable, and interesting creatures'.⁷¹ These space creatures have curious names that remind Benjamin of the 'dehumanized names' that the Russians give their children – October, after the month of the Revolution, or Pyatiletka, after the five-year plan, or Aviakhim, after an airline. This is not 'the technical renovation of language, but its mobilization in the service of struggle or work – at any rate, of changing reality instead of describing it'. The language of fantasy could act like a magic spell, producing a world of new relations, instead of describing the old one. That in a sense is what any utopia has to be. It must be future-oriented, aimed at changing the world, or at least observing the possibilities inherent in the description of the now, which once named might then be released into actuality, in the sense of allowing it to unfurl, in the future.

TO EARTH WITH A BUMP

Instead of Scheerbart's glass palaces, great factories of brick were built in Germany as elsewhere. Rapidly too new types of industry emerged. Electrochemistry and electricity generation demanded new sources of energy. Previously useless lignite, a substance between peat and coal, was deployed. Lignite extraction modified the landscape. Marl, sand, clay and gravel were shifted, exposing the innards of the earth in open-cast mining. More factories appeared and power stations were built and transportation routes that connected them to each other and to points of further circulation. Electricity circulated through cables and turned the dark of night into light and replaced the clunking and clanking of mechanical means of transferring power via cogs and stops with a silent streaming or a barely audible hum. The changes went beyond visual and sonic appearances. For example, in the 1870s in the areas where lignite mining had been most intensive the first effects from the sinking of the ground-water level were seen. Trees were parched, even the ancient oaks that had survived for so long. Elsewhere flora died and drinking fountains dried up. Above and below worlds were not disconnected from each other. Aerial photography made apparent these vast changes in the landscape. Factories were always better grasped from an aerial perspective. And these were great factories. A number of the largest were for the production of colour stuffs. By the beginning of the twentieth century six firms dominated the world market in production and sales of synthetic colour stuff. The three biggest were BASF, Bayer, Hoechst, followed by the smaller AGFA, Cassella and Kalle. AGFA and Bayer began to develop photographic technologies, chemicals and papers. Another great chemical industry of substitution was plastics manufacture, which drew on developments in cellulose products. Celluloid, a blend of pulverized gum-camphor and gun cotton, a replacement for gunpowder, was used, from the 1870s, as a substitute for ivory and tortoiseshell, amber, shell lacca and horn, as well as vulcanized rubber in the dental industry. It was also used for shirt collars, cuffs and false shirt-fronts. Cellulose nitrate was used to make artificial fibres, specifically, in the 1890s, artificial silk or rayon, and cellophane. More substitutes, ever closer to the body, emerged, and a new world of see-through packaging destined to be waste loomed. Celluloid also found use as film stock, made at AGFA from 1909. This new transparent material celluloid could be in the world and show the world to itself. Glass utopias were replaced by celluloid illusions.

Class Struggle in Colour

SYNTHETIC COLOURS AND DEATH

Chemists had invented colours for all sorts of surfaces and textiles and they had made coated papers on which the cosmos could be caught. They had also been busy inventing other synthetics, substitutes, compounds and coatings from coal-tar and other waste materials. Antipyrin was the first drug produced by Meister, Lucius & Brüning at Hoechst, in 1883. Phenacetin, made of the waste stuff para-nitrophenol, and heroin, synthesized in 1898, were Bayer's first contributions. The range and types of synthetic colours expanded as well. In 1888 Robert Emanuel Schmidt made alizarin blue, and lodged the first anthraquinone dyes patent at Bayer. In the same year the use of chrome tanning agents began, which enabled the development of coloured leather. A new generation of synthetic dyes, the indanthrene colours, were so stable, being light-fast, waterproof and boilable, that their lives exceeded those of the cotton to which they were fixed. Dyers fretted about the prospects of the industry, fearing that fast colours would deter new purchases. Fischer, the leader of German *Farbenpropaganda*, insisted that 'If the dyers will not buy indanthrene voluntarily, then we will just have to compel them.' The consumers too were targeted by indanthrene's symbol of a large letter I with raindrops and a sun, in an effort to inform and appeal. The dye industry indulged in packaging and marketing. At Hoechst's Farb Werke the labels on packets of dyestuffs conjured up attractive, highly coloured scenes of exotic lands or colonial possessions, cute and dramatic images of animals and wild beasts, and of beautiful women, naturalistic or allegorical.¹

By the turn of the century, chemistry appeared as the unstoppable conqueror of nature. It had enabled heroic scientists to notch up victory after victory. More and more chemical industries and their products were exhibited in celebratory volumes. Slim pamphlets rendered the achievements as part of a triumphal story of progress. Chemistry was a heroic pursuit and German chemistry was the most successful. In 1913 Bayer employed 10,000 workers, and had more than 8,000 patents at home and abroad. That year the factories along the Rhine and Main delivered about a quarter of the

world market in chemicals. The German colour industry produced about 85 per cent of world colour needs around 1914. The aniline dye industry combined with the lake, varnish and stain industries, and new uses for coal-tar dyes were planned: in wood staining and varnish-making, in artists' colours and in tinting materials such as paper, linoleum, leather, furs, ivory and horn. Wood types could be faked by tricks of staining, and it was possible to colour hard substances, such as ivory substitutes, artificial horn, amber and bone, used in the manufacture of buttons, electric insulators and billiard balls. A synthetic world was emerging. As it took shape, so too did its mirroring in a new anti-naturalist barbarism, manifest as high-flown paeans to synthetics and dazzling colours by artists alert to this 'second nature'. The embrace of anti-nature and industrial potential was an impulse of artistic modernism – and it was global in form.

VILE COLOURS

In the last fortnight of 1913 a group of London-based artists, led by Wyndham Lewis, produced a periodical. Its name was *Blast*, and its emblem was a vortex. *Blast* was conceived as a celebration of the blast furnaces of the industrialized Midlands and the North. *Blast*, the title, suggests a bracing hygienic gale from the North. The emblematic representation of the vortex on the first pages of *Blast* shows a storm-cone with its apex pointing upwards: a signal used by coastguards to denote strong winds from the north. This is the north of industry, and as such the anti-south, a riposte to the Mediterranean of sunlight, pastel shades and 'Futurism'. Moonlight, starlight, the gentle beauties of nature are denied in this new art. *Blast* praised the sea, with its squalls of rousing air, and it applauded Anglo-Saxon machinery. *Blast* summons shock, as well as being a vituperative outburst of frustration. Douglas Goldring found a printer, Leveridge and Co., in Harlesden, a London suburb. The printer seemed 'humble enough blindly to carry out his instructions'.² The journal was to be typographically striking. Its cover was a foot's length of lurid pink. Its paper was thick and rough. The journal was a fat pink slab of invective and black ink and it appeared with a date, 20 June 1914, to specify the very moment of its interruption of art history. As Richard Aldington, one of the signatories of its manifesto, described it at the time:

it is a huge pink periodical of 160 pages. The title 'Blast' is printed diagonally across both covers. There is no time for detailed criticism, but from a hasty glance through the manifestos and some of the contributions, I can declare that this is the most amazing, energised, stimulating production I have ever seen.³

One of the closing entries in *Blast* was titled 'Our Vortex' and it declared frustration at the recent art movement of Impressionism:

As to the lean belated Impressionism at present attempting to eke
 out a little life in these islands:
 Our Vortex is fed up with your dispersals, reasonable chicken-men.
 Our Vortex is proud of its polished sides.
 Our Vortex will not hear of anything but its disastrous
 polished dance.
 Our Vortex desires the immobile rhythm of its swiftness.
 Our Vortex rushes out like an angry dog at your Impressionistic fuss.
 Our Vortex is white and abstract with its red-hot swiftness.⁴

Contradiction figured in this petition of modernity. Speed turned into immobility (countering Marinetti's Futurist blur); red and white exchange places, just as they do under conditions of super-heating; disaster wears a polished look. Impressionism's blurs were as offensive to the Vorticists as Futurism's whirr, which was dismissed by Lewis as a fascination with the novelty of machinery indulged in by a backward nation.⁵ *Blast* reeked of assertion and industry. Its typography was black and solid, evoking newspaper headlines rather than tasteful art-salon brochures. Apart from the cover's diagonal rip of language, the type sat squarely on each page, blockish and dark. This was in sharp contrast to Futurism's *parole liberta*, twisting and twirling across the pages. But it was the cover's colour that issued the first shock. Lewis 'planned and launched the hugest and pinkest of all magazines, *Blast*, whose portentous dimensions and violent tint did more than would a score of exhibitions to make the public feel that something was happening'.⁶ In a letter to Lord Carlow, in July 1914, Lewis described *Blast* as a 'puce monster'.⁷ In *Blasting and Bombardiering* in 1937, he recalled that it had 'a page area of 12 inches by 9½' and was of a 'puce colour', adding that 'in general appearance it was not unlike a telephone book'.⁸ No one could ignore the cover. The critics all mentioned it. Ford Maddox Hueffer called it purple in *Outlook*. *The Times*, in its edition of 1 July 1914, deemed it 'bound in purple paper'. *The Athenaeum*, *New Weekly* and *New Statesman* decided upon magenta. *Poetry* called it cerise. *The Morning Post* decided that it was 'a vast folio in pink paper covers, full of irrepressible imbecility'.⁹ *The Little Review* decided on 'something between magenta and lavender, about the colour of a sick headache'. *The Egoist* called it pink. *The Pall Mall Gazette* coined 'chilled flannelette pink', and noted that the colour 'recalls the catalogue of some cheap Eastend draper, and its contents are of the shoddy sort that constitutes the Eastend draper's stock'.¹⁰ *The Observer's* reviewer settled on 'a peculiarly aggressive pucey pink'.¹¹ The colour oozed vulgarity. Some of its supporters 'dressed Vorticist' in colours whose garish brightness celebrated the cover,¹² despite Lewis's sneer in *Blast*, on the opening page under the title 'Long Live the Vortex', a paean to the individual and the 'timeless fundamental Artist that exists in everybody':

We do not want to make people wear Futurist patches, or fuss men to take to sky-blue and pink trousers.
We are not their wives or tailors.¹³

Blast was written by self-styled 'Primitive Mercenaries'.¹⁴ It spoke for the savage artist mingling in the 'enormous, jangling, journalistic fairy desert of modern life', which 'serves him as Nature did more technically primitive man'.¹⁵ The journal was designed to crash into the European art scene and cause a stir. The Vorticists had no qualms about alienating members of the art and entertainment establishment, some of whom were 'blasted' in a list of cultural enemies, although the legal liability of printer and publisher meant that libel had to be avoided.¹⁶ There were many targets in Britain alone, for, as the first issue of *Blast* put it: 'England is just as unkind and inimical to Art as the Arctic zone is to life. This is the Siberia of the mind.'¹⁷

Evanescence and the stunned joy of fleeting intensity were modernist themes. Lewis alludes to these themes in the essay 'Futurism, Magic and Life', where he notes how the most perishable colours in painting (such as Veronese green, Prussian blue, Alizarin crimson) are the most brilliant.¹⁸ That which burns brightest burns most intensely and disperses, and, in true modernist fashion, brilliance must be but flitting, meteoric, not eternal, a coincidence of moment, viewer and object. Lewis proclaims of this: 'This is as it should be: we should hate other ages, and don't want to fetch £40,000 like a horse.'¹⁹ Commodification and the archive are repudiated. Vorticism discards romanticism about the past, which seems to them evoked in French Cubism, with its studio motifs of guitars, models, still-lives and subtle colours in the narrow range of blue through green to grey-brown. Cheap industrial materials have implications for art. 'Orchestra of Media' insisted on abandoning oil paint in favour of other instruments and media, for the 'surfaces of cheap manufactured goods, woods, shell, glass etc already appreciated for themselves and their possibilities realized, have finished the days of fine paint'.²⁰ Lewis insists that the possibilities of colour have been hardly exploited. Discord and 'odious combinations' have to be tried out. Lewis praises the ABC tea shops as place of inspiration for a contemporary artist. 'With its trivial ornamentation, mirrors, cheap marble tables, silly spacing, etc.: it nevertheless suggests a thousand great possibilities for the painter.'²¹

In an essay in *Blast*, titled 'The Exploitation of Vulgarity', Lewis speaks of how Ingres' wife would raise a shawl to his eyes to block from his gaze the sight of an ugly or comely person. Today, observes Lewis, we crave ugliness. 'We don't want today things made entirely of gold (but gold mixed with flint or grass, diamond with paste etc) any more than a monotonous paradise or security would be palatable.'²²

In 'Life is the Important Thing', Lewis attacks naturalism and the painters of nature, who are never adequate to their subject matter. Artists with feeble

imagination stand 'in front of Infinite Nature with their little paint box'.²³ Realists had to paint what was under their noses, such that unruly and independent lines were suppressed and the colours were compelled to be natural, or at least plausible. In a testament on Vorticism written later, Lewis states:

It was, after all, a new civilization that I – and a few other people – was making the blueprints for: these things never being more than that. A rough design for a way of seeing for men who were not yet there. At the time I was unaware of the full implications of my work, but that was what I was doing. I, like all the other people in Europe so engaged, felt it to be an important task. It was more than just picture-making; one was manufacturing fresh eyes for people, and fresh souls to go with their eyes. That was the feeling.²⁴

Fresh eyes and fresh souls were opened to the rottenness of art and life. Ezra Pound was requested to submit 'something nasty' for *Blast*²⁵ and presented some condensed Imagist poems (of 'no particular merit and some of no merit at all', in the opinion of *The Times*'s reviewer) on colour, artifice and chemicality. Their nastiness lay in their reference to the modern age's fakery and chemical inauthenticity. Ezra Pound's condensed Imagist poems on colour, artifice and chemicality fizzled on the pages of *Blast*.

Women Before a Shop.

The gewgaws of false amber and false turquoise attract them,
'Like to like nature'. These agglutinous yellows!

L'Art.

Green arsenic smeared on an egg-white cloth,
Crushed strawberries! Come let us feast our eyes.

The New Cake of Soap.

Lo! how it gleams and glistens in the sun
Like the cheek of a Chesterton.²⁶

These slogan poems distil a vicious modernism, in love with while in hate with modernity's possibilities. The poems, like the modern epoch, are poisonous and potent, fascinated with twinkle and deception. In 'Women Before a Shop' consuming women are attracted to baubles, to the fakery of the commercial. They fall for a cheap trick to pull in the punters. They are attracted because they themselves are no different, like eyes up like. Each is as artificial, deceitful and hideous as the others. 'L'Art' vituperates against art, in the modish French sense, as a *mélange* of malignant deceitful tint and faked useless nature. This 'feast for the eyes' evokes a deadly mess of ruined nature for those who know no better. 'The New Cake of Soap' parodies formal appreciation on the part of art lovers, by conceiving the aesthetic pleasures of

a bar of soap, cleanliness being its aim, just like the good, clean, ever-so-English middle-class sentiment of G. K. Chesterton, whose political fantasy *The Napoleon of Notting Hill* (1904) indulged the romance of a pre-industrial world. Soap would have no part there. Soap was an industrialized product. It claimed to bring about cleanliness and purity through the most caustic of means. Mass-produced soap threatened to wipe the smile off Chesterton's cosy moralism.

The second and final issue of *Blast* was the 'War Issue' of July 1915.²⁷ It opened with reference to 'this puce-coloured cockleshell', but its cover was a less striking light beige and black, and bore a machinic dehumanized image by Lewis called 'Before Antwerp'. Angular soldiers cocked machine guns in a metallic tangle of energy and fatality. Once more much of the prose was given over to offensives against other art movements. In 'A Review of Contemporary Art' Lewis argued:

In painting the IMPRESSIONISTS wished in everything to be TRUTHFUL. It was the age of scientific truth. Colour out of the earth had to imitate the light. The pigment for its own sake and on its own merits as colour was of no importance. It was only important in so far as it could reproduce the blendings of the prism.²⁸

Even though the Impressionists moved towards an analytical and scientific understanding of the world, they were trapped in representation, imitation of external appearance, and their aim was to imitate light in oil paint.²⁹ Lewis lambasted the Impressionists for their subservience to nature. Their sole legacy was to habituate the public to brighter colours. Lewis desires a pure experience of colour. Abstraction not slavish imitation is the aim. Writing of William Roberts in 'The London Group', Lewis praises the exploitation of 'cold, effective, between colours of modern advertising art'.³⁰ A short piece under the title 'Life Has No Taste' attempted to introduce egalitarianism amongst objects:

It is, in fact, rather the same thing to admire EVERYTHING in Nature around you - match-boxes, printed dresses, ginger-beer bottles, lamp-posts, as you admire every aesthetic manifestation.³¹

There is an equality of objects in the world. In the case of art, however, Lewis finds representation, especially of human beings, animals or trees, reprehensible. There should be only abstraction. Nature cannot be imitated, but it is possible to learn from the processes of Nature.³² The true artist does what Nature does, with the added beauty of accident.³³ Study of the patterns on a surface of marble is recommended.

Da Vinci recommends you to watch and be observant of the grains and markings of wood, the patterns found in Nature everywhere.

The patterned grains of stone, marble, etc., the fibres of wood have a rightness and an inevitability that is similar to the rightness with which objects arrange themselves in life.³⁴

But the important thing is to be able to make patterns like them without the necessity of direct mechanical stimulus.³⁵ 'Modern Caricature and Impressionism' argued likewise for nature's legitimacy as an 'object', producing textures, effects, forms, rather than a pictorial subject.

We are not attacking the method of working from Nature. If that is doing without any literary objective, and only from interest in the OBJECT AS AN OBJECT, the result can be such as is found in Van Gogh, Manet or Cézanne.³⁶

In 'The London Group' Lewis insists on 'LIFE not Old Masters' and rejects art that is dead with heavy woodness or stone. In its place he celebrates 'flashing and eager flesh, or shining metal'.³⁷ The Vorticists woke in a world that was machinic and chemical. While Lewis publicly scorned Marinetti's 'Futurist gush over machines, aeroplanes, etc.', he was impressed by Marinetti's recognition that humans are changed by living in cities with communications and transport at their disposal. In the city the sheer noise of urban existence, the screech of tram brakes, the roar of cars, the hum of machinery, wipe out traces of old-style individuality. In Vorticist stylization the denial of the human form is executed in a heightening of the flat surface of the image, and in a paring down of the elements involved. Lewis's pictures present the human form as if it were constructed of girders and industrial mouldings. For Lewis, THE ACTUAL HUMAN BODY BECOMES OF LESS IMPORTANCE EVERY DAY. It now, literally, EXISTS much less.³⁸ Lewis's imagery aimed at a sort of masculinized androgyny. Interiority is expelled like dust by a sharp gust of *Blastish* air. Nature is on the run from art. *Blast* had burst onto the scene before war, but it was evacuated once the bombs were blasting and at least one of its artists, Gaudier-Brzeska, was scattered across a northern European field, as shattered and abused as the Vorticist designs in *Blast*.

The editorial of the War Issue of *Blast* stated that Germany must not win the conflict, because Germany stands for Romance, 'the poetry of a former condition of life, no longer existing'. The war on Germany was justified aesthetically, then, though this was an aesthetics that spilt over into life itself. The journal sought to voice a new 'as yet unexpressed spirit of the present time, and of new conditions and possibilities of life'. If official Germany was to be crushed for its contribution of Romance, including the romance of the nation, this did not mean the damage should extend to 'unofficial Germany':

Unofficial Germany has done more for the movement that this paper was funded to propagate, and for all branches of contemporary activity in Science and Art, than any other country.³⁹

POSTCARDS FROM THE FRONT

War brought problems and opportunities for Germany's industry, official and unofficial. Carl Duisberg, head of Bayer's works at Leverkusen, observed in 1919 that the chemical industry was not prepared for war. It was a disaster for the industry, causing disruption to trade, for so much trade had been with powers who were now enemies.⁴⁰ Some countries put their efforts into expanding their own colour industries. The Swiss colour industry, which previously had used German intermediary products, became independent. A sea blockade by the British fleet cut off access to some raw materials, such as oil and rubber, and this impelled further the search for substitutes. But there were more pressing things for the German chemical industry to make: gases and explosives. The chemical industry, noted Duisberg, realized that they had no choice but to help the war effort. Industry was re-gearred and profits were made. The average profit rate in the chemical industry in the first year of war rose from 19 per cent to 35 per cent.⁴¹ The chemical industry also saw a potential source of labour in occupied lands. In 1916 Carl Duisberg suggested that the highest military command open up the Belgian reservoir of labour power. By the middle of November 1916 the German occupiers had taken 40,000 Belgian men prisoner and transported them to German factories and mines. Each day more were added, until 60,000 had been deported.⁴² But it was unproductive, for the prisoners could not be forced to work hard enough.

To improve the factories' status in the war effort an 'Interessen-Gemeinschaft', interest community, was formed in 1916. Walter Rathenau, son of the founder of AEG, the giant electrical concern, established a commission within the war ministry to investigate supplies of raw materials necessary for the war effort. A lack of nitrate for gunpowder troubled the commission most. The loss of Chilean guano reserves, a rich source of ammonia and nitrogenous compounds, now blockaded, meant that new sources of nitrates needed to be found. The state and industry collaborated, and raised unlimited funds from huge loans, amounting to around 432 million marks.⁴³ Fritz Haber was engaged, for he had synthesized ammonia, important for mining and fertilizing, as well as explosives. Ammonia was a crucial ingredient in the production of nitric acid, a raw material for the production of chemical high explosives and other ammunition necessary for warfare. Haber helped too in the development of chemical warfare, directing the first gas attacks, the large-scale release of chlorine gas at Ypres in April 1915. In 1927 Fritz Haber reflected on the importance of chemistry in this war:

The human body with its two square metres of surface presented a target, which could no longer innocently be tempted out to the defended position against the whirl of iron from machine guns and cannons. The defender in his earth shelter could not be defeated by the storm, because not enough of the flying pieces of iron reached him. It was a matter for natural scientific fantasy to foresee this situation and to alight upon the remedy, made possible by technology. This remedy is gas warfare.⁴⁴

Gas warfare was a remedy. In 1925 Walter Benjamin reflected on how 'the coming war' would be fought chemically, and he named the 'tongue twisting chemical vocabularies' of the gaseous killing tools manufactured by IG Farben.⁴⁵ Mustard gas eats the flesh, devastates all vegetation and sources of food and leaves its burning imprint on all surfaces for months. Lewisite, a blister agent, poisons the blood and kills instantly. There is no hiding place from the seepage of gas, a 'literally "breath-taking" hazard'. But for some, gas war, the pyrotechnics of explosives and the dominance of military machinery, combined to make a new techno-sublimity. That, at least, is how it seemed to Ernst Jünger, the officer-chronicler of the war, in his various books and photo-essays. Jünger relished the dramatic colours of gas and fire, exploding fireworks and the metallized nature of the battlefield, which appeared to him not as a grey-brown sludge, but an intensified realm of operation and danger, and a zone of display. In *Stahlgewittern: Aus dem Tagebuch eines Stoßtruppführers* (In *Storms of Steel: From the Diary of a Raiding Troop Leader*) of 1920 describes the textures of this new 'front-experience'. On the battlefield bullets sparkle and fizz like fireworks, tracing their way through thick clouds of smoke and colourful gases. This is techno-sublime aesthetics, where even war is like a marvellous performance. Steel swarms pierce the blue, flares flash up and explosions prick the air and star shell phosphorus explodes to illuminate the battlefield. In the final chapter of the book, 'The Great Slaughter', Jünger describes a battle in March 1918. The battlefield is a place where 'Even the laws of nature seemed suspended. The air quivered, just as in the scorching days of summer and its flicker sent stationary objects dancing to and fro. Black shadow lines flitted through the clouds.'⁴⁶

This place where the laws of nature were suspended was more like a factory, a great turbine hall producing death and pain on command.

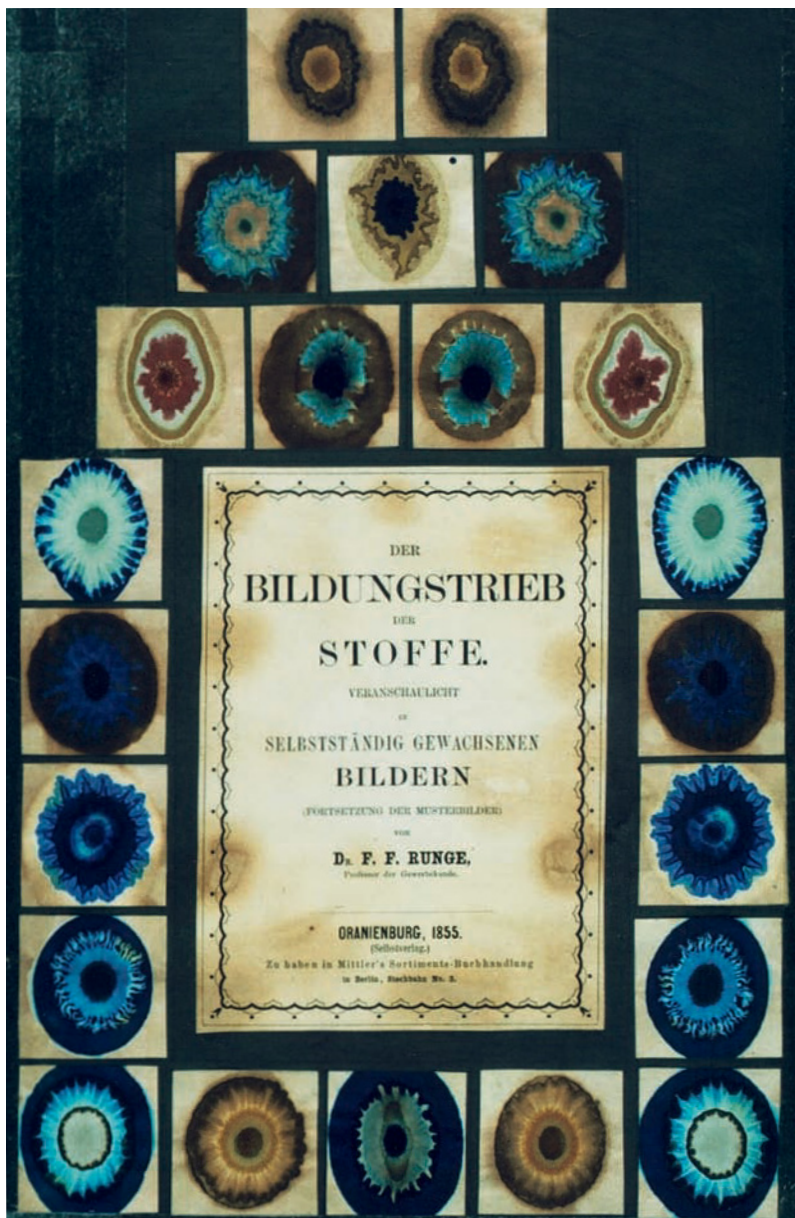
The modern battlefield is like a huge resting machinery, in which countless hidden eyes, ears and arms are unoccupied waiting for the minute on which it all depends. Then, as a fiery overture, a single red flare from one or other hole in the earth travels into the skies, and a thousand guns bellow simultaneously, and with one blow the work of destruction, driven by countless levers, begins its crushing operation.⁴⁷

The metabolic rupture between humans and nature had culminated in war. In war the earth suffers collateral damage through bombs and dugouts. Humans use technology to perpetrate violence against nature, but also, in as much as they too are nature, they violate each other in a metallized landscape of bullets and tanks. The Great War modified the German landscape. Its explosives and deadly gases emerged from the same technologies and the same mined and processed materials as the synthetic colours of the new rainbow. This metallic nature of a new kind was caught on the new technologies of mediation, photography and film. Military moments, fragments of a new shock-experience, could be collated, and Jünger collected them. His war books included luxury photograph albums such as *Die Unvergessenen* of 1928 and *Das Antlitz des Weltkrieges: Fronterlebnisse deutscher Soldaten* of 1930. War pictures were snapped from all perspectives, blasting open the field of vision: reconnaissance 'before and after' photographs of villages, black bombs frozen in mid-drop, troop line-ups clutching graffitied shells, battlefield action, trench life and trench death. Some of these scenes found their way past censors and onto picture postcards and into pictorial journalism for the masses.

In *Blast* Wyndham Lewis noted the new materials of art and he recognized new dimensions. Art could be cut down in size. He wrote of the possibilities presented by the picture postcard.⁴⁸ Other avant gardists also seized on the postcard format and played with the danger of genius. In July 1916 Oskar Kokoschka sent a picture postcard to Willi Baumeister. It was a photograph of himself as a war volunteer. Another was sent in November 1916, and this time it was a portrait of the artist as *Stürmer*, a simultaneously military and meteorological reference to 'Der Sturm', the expressionist art circle and its journal, which was the first to reproduce, discuss and defend Kokoschka and other Expressionists.⁴⁹ Kokoschka did, however, scratch out the printed blurb with his birth date and achievements, facts for a public image. Baumeister and Kokoschka were part of a circle that included the architect Adolf Loos and the satirical magazine editor Karl Kraus. The German Expressionists liked the postcard form and they liked to exchange this abbreviated missive between themselves. They made little artworks of postcard size and sent them to each other. Their Expressionist aesthetic was well suited to the postcard format. The imagery on a postcard could be a spontaneous drawing, not a painting. It might be heavy-lined scenes of figures or trees in black and white or a water-colour graphic, quickly and loosely sketched.⁵⁰ The postcard was not bombastic but familiar and it shared the dimensions of domestic photography, itself an intimate form, to be held in the hand and often a portrait of those nearest and dearest to the viewer. In addition, the postcard suited well the group ideal of the Expressionists. It was a way of maintaining contact on an artistic footing. Sometimes the Expressionists fuelled the cult of the personality by sending photo-postcards of their own portrait. Postcards circulated and reinforced the bonds of friendship and the artistic group. Friendship was a community of choice and it replaced the conventional bonds of family, especially for these

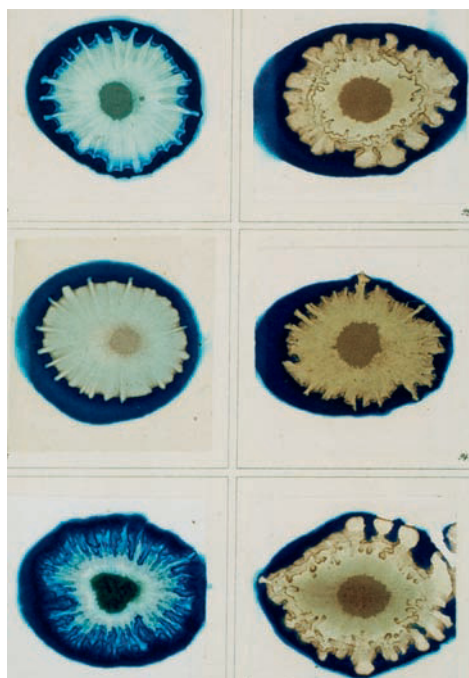
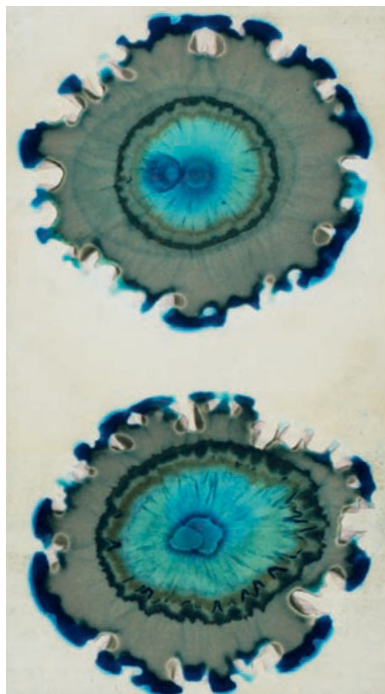
bohemian types who were known for their generational revolt. But postcards, a vehicle of communication and communion, presented a paradox, for, as a modern form of mass communication, their intimate gestures were on public display. Postcards were a product of mass production and standardization. Once the initial resistance to the postcard's non-private nature was overcome, the format was immensely successful and presented another platform for the public leading of lives: in its pre-paid version it could be viewed as a stamp for writing on. The materiality of communication was reduced to its naked, public economy, unlike letters with their paraphernalia of folded paper and envelope. Simplicity and brevity were the postcard's virtues, said Heinrich von Stephan in 1865. Five years later he became German General Post director and promoted the postcard in the German postal system.⁵¹ In war the postcard won out with the public. The German–French war of 1871 saw the introduction of the *Feldpost-Correspondenzkarte*, and in 1872 the postage for postcards was halved. Postal communication in general developed further through devices such as letterbox slits in doors and anonymous postmen. Pre-gummed envelopes cut down on fiddliness. The postcard's pre-printed text and pre-existent picture signalled further losses of postal intimacy, and these changes were made according to a standardized format.⁵² Mass communication and mass reproduction unite in the postcard. Industrial methods allowed for a broader range of illustrations, and, after 1905, a division of labour on the card meant that the message could be written on the back of the image, alongside the address. This boosted the status of the image, and turned the postcard from simply a vehicle of communication into a memento. While postal intimacy disappeared through the exposed nature of the communication, the choice of imagery re-personalized the postcard, within certain parameters. The Expressionists took this personal aspect further, using their own designs produced within the postcard format in order to reinvoke community through postal communications. The mass nature of the postcard was contravened. For this circle of artist-friends, sending postcards was more than a convenient mode of contact. As well as being a regular modern pastime, sending postcards amounted to a modern aesthetic, and the Expressionists were becoming not only well versed in mass cultural practices, but also adept at their *bouleversement*.

Karl Kraus's magazine of social criticism, *Die Fackel*, imported the postcard aesthetic, with its virtues of brevity, economy and negotiation of a mass format, making it the basis of an innovative montage practice.⁵³ Kraus often wrote his satirical commentaries by pasting a disagreeable newspaper clipping onto a piece of paper and encircling it by his comments. Sometimes the magazine would print contrasting news reports in parallel columns, in order to expose duplicity.⁵⁴ Lies and hypocrisy were bared in ironic juxtaposition, and critique emerged, pearl-like, from the irritations of actuality. Kraus sought a visual analogue to this practice. In July 1911 he inaugurated satirical photomontage in a frontispiece titled 'Der Sieger' (The Victor). This

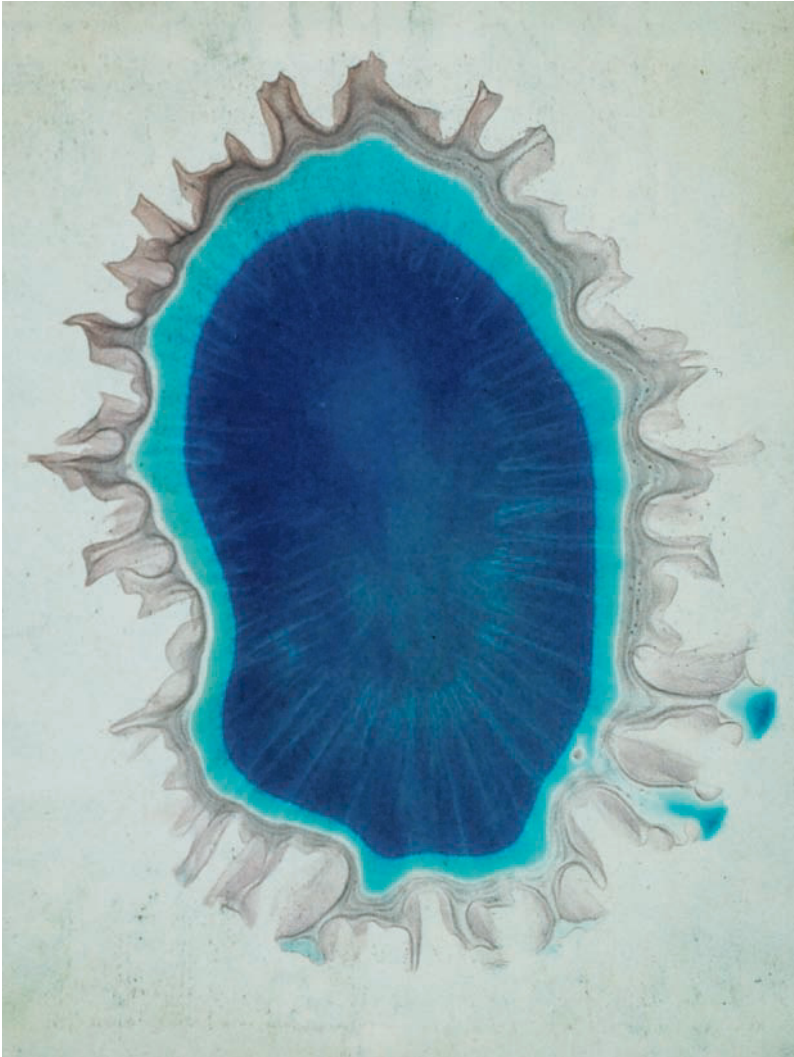


Cover of F. F. Runge's *Der Bildungstrieb der Stoffe* (Oranienburg, 1855).

'Bildende Stoffe',
figure 31 in Runge's
*Bildungstrieb der
Stoffe*.



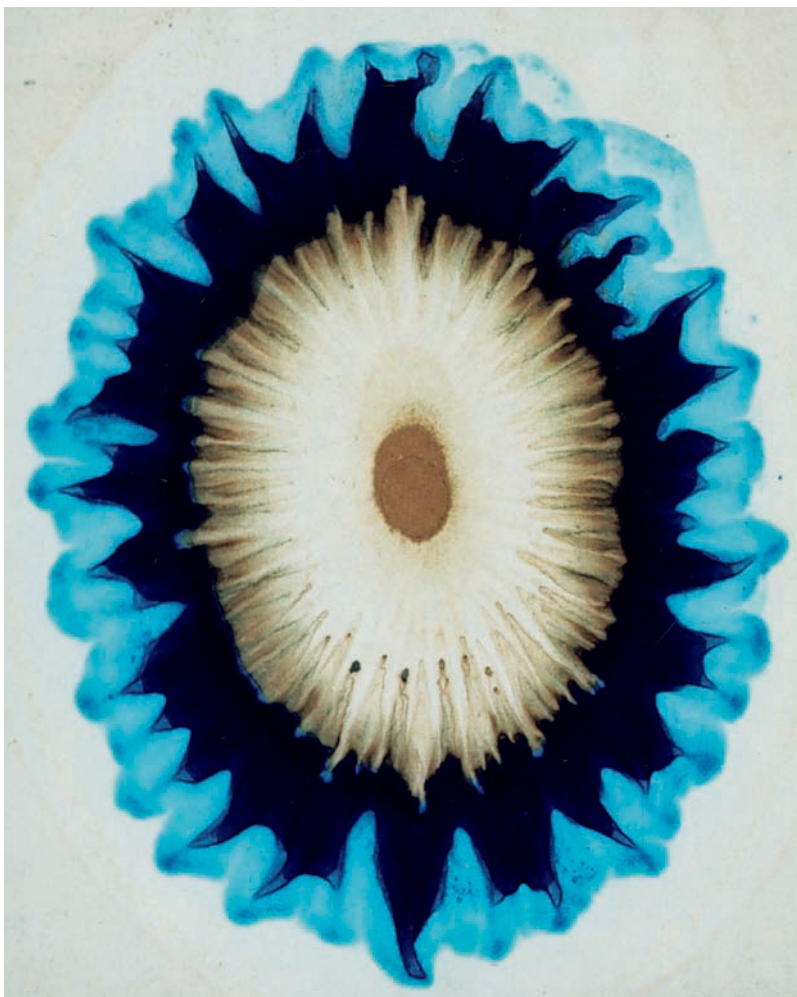
A page from
Runge's *Zur
Farben-Chemie*
(Berlin, 1850).



An image from Runge's experiments: nature looks at us.



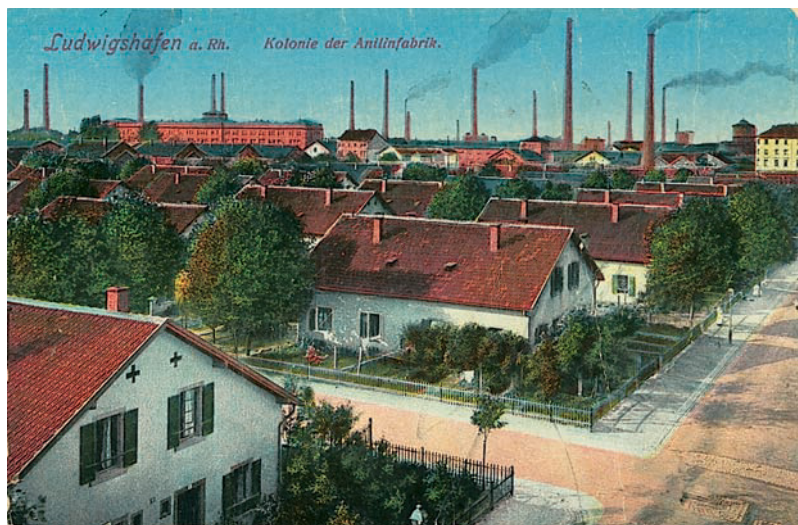
An image from Runge's experiments: every picture has a history of its coming into being.



An image from Runge's experiments: *augenscheinlich*, or apparent to the eyes – nature looks back – nature looks at us.



A postcard advertising indanthrene dyes, early 1930s. On the reverse is the slogan 'Indanthrene! Remember the brand: no washing, no fading!'



A postcard showing the housing colony for the aniline factory in Ludwigshafen.

IG Farben's headquarters in Frankfurt, with swastikas: the frontispiece of their 1938 publication *Erzeugnisse unserer Arbeit*.



'The Empire of Colours', chapter heading in *Erzeugnisse unserer Arbeit*.



Willi Baumeister, *Jokkmokmädchen*, 1941, collaged after *Terpsichore*, a painting by Hitler's favourite painter, Adolf Ziegler.

Willi Baumeister, *Mahn mit Spitzbart*, 1940s, collaged after Ziegler's *Göttin der Kunst*.

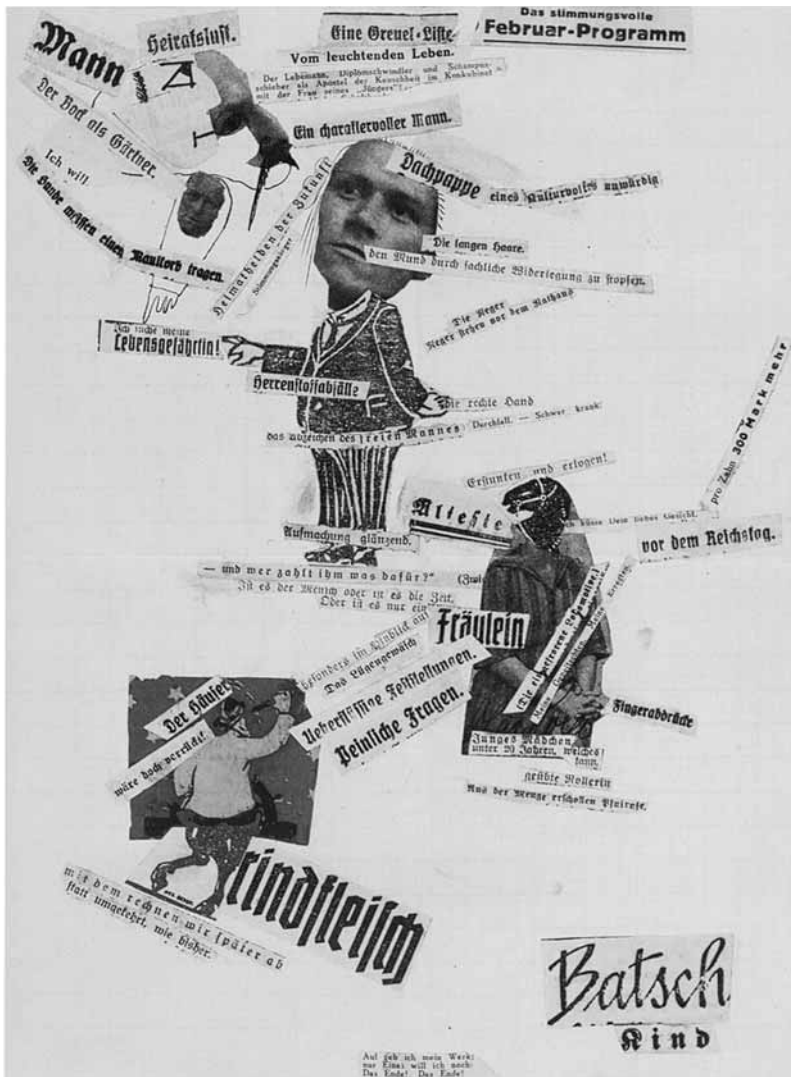
Willi Baumeister, *Mahn mit Spitzbart*, 1940s, collaged after Ziegler's *Terpsichore*.

portrayed Moriz Benedikt, owner and editor of the *Neue Freie Presse*. A photograph of Benedikt had been cut out of a magazine and stuck onto another magazine photograph. Benedikt's figure was placed beneath a statue of *Athena* in front of the façade of the Austrian parliament. This was Kraus's response to the election victory of the *Freisinnigen*, a Liberal party supported by Benedikt. His point is that power resides with the press and not with the democratic ideals symbolized by the Athenian goddess of wisdom.⁵⁵ The idea was expressed through the interrelations between the component parts of the documentary materials, anchored by the title. This was in much the same way that John Heartfield would proceed in his picture quotations: first in his alterations of war postcards, carried out with Georg Grosz, in 1917, and then more publicly some years later, beginning with the photomontaged poster 'After Ten Years: Fathers and Sons' (1924). For 'The Victor' montage Kraus insisted on the importance of naming the photography studio responsible for snapping Benedikt in order that the image not be mistaken for a caricature. As John Heartfield would later underline in his 'Executioner of the Third Reich' magazine cover of September 1933, through the highlighted use of an unaltered photograph of Göring's monstrous head, reality is already that extreme. Kraus claimed that the most unlikely scraps of dialogue in his play *The Last Days of Mankind* were authentic quotations. Excerpts of reality are set in 'gruesome contrast',⁵⁶ and the reality depicted distorts to reveal its true face. Kraus's practice distinguished itself from another mass-format operation. In Vienna between 1907 and 1912 Adolf Hitler designed and sold touristic images on the streets and in the taverns, producing batches of one to three a day. These were quickly sketched scenes, sometimes copied from pre-existing postcards, and generally postcard-sized to fill the empty frames in bars and art shops.⁵⁷ The scenes depicted were predictable: Vienna for tourists, an edited ideal-reality.

Willi Baumeister visited Vienna in 1915 and 1916 and met Loos, Kraus and Altenberg. Shortly afterwards, he began his word collages, a mix of image and excerpted text whose satirical tone echoed that of *Die Fackel*.⁵⁸ The words were part-sentences snipped from newspapers and the images were photos or drawings from advertisements, packaging or promotional materials. Much of it seems to come from the *feuilleton* section, the cultural pages of the newspaper. 'The Man on the Candelabra' used various instances of the language of scandal and cliché, lines such as 'an office clerk who was loyal for many years'.

Other cut-out lines observed that 'he is a model German' and referenced 'the soul of the *Volk*'. It continued:

Now, after tallying numerous unpaid bills and document falsification in a Berlin hotel, he has abducted the proprietor's eighteen-year-old daughter to Warsaw, pendulous bosom . . .



Willi Baumeister, *Ein charaktvoller Mann*, c. 1916, collage and ink on graph paper.

in a series of collisions the phrases: 'Long hair, to cram the mouth with factual contradictions, the Negroes, Negroes stand in front of the town hall', and further down, the political theme repeats: 'I kiss your lovely face in front of the Reichstag (the frozen locomotive, my whipped one, my aroused, per tooth 300 marks more, fingerprints . . . '.

The themes of commerce and language - the concerns of the press from which the lines are drawn - featured prominently in 'A Characterful Man':

Gleaming presentation - and who pays him how much for that? is it the person or the age. Or is it only a, girl, especially in respect of, the wash of lies, superfluous determinations, embarrassing questions.

Baumeister's poem-images ushered in Dada montaging, such as in the work of Hannah Höch, where materials and words were ripped from popular illustrated magazines and reset in new picture fields. Hannah Höch's *Dada-Panorama*, of 1919, for example, used a similar distribution of mass media straplines and excerpts, all taken from the *Berliner Illustrierte Zeitung*. Grosz-Heartfield's collages from 1919, such as 'Sonniges Land' (Sunny Land) and 'Dada-merika', scattered references to the new art movement and snips of political-national press ideology over images of Wilhelmine Germany, advertising and the machinic. Georg Grosz continued the practice of recombining mass materials with a postcard in 1921. He altered a standard format tourist shot called 'Steilküste am Nordufer der Insel Hiddensee' (Shelving Coast on the Northern bank of Hiddensee Island) by pencilled additions of a tree, a flag, a moon, a Zeppelin and two boats. Dadaists described this as 'corrective practice'. Duchamp amended a reproduction of Leonardo da Vinci's *Mona Lisa* (1919), adding a moustache and a punning title. Grosz and Heartfield vandalized a reproduction of a work by Picasso, renaming it 'La Vie Heureuse, Korrigiertes Meisterbild' (The Happy Life, Corrected Master-piece). This was reproduced in the catalogue for the First International Dada Fair of 1920. Dada itself was not immune from this improving exercise. Höch and Raoul Hausmann collaborated on a type of corrective in 1920, in *Dada-Cordial*. A double-page spread from a proof of the first issue of *Der Dada* (15 July 1919) was overlaid with various items including a photograph of a Masai warrior, images of a piston rod and other machine parts, stickers, stamps and found-drawings of beetles. Willi Baumeister was 'correcting' again in the early 1920s, probably in league with Oskar Schlemmer and Gustav Schleicher, altering a copy of a programme from the Cabaret Voltaire of 1916 by pasting in further text and photographs. It is as if the Dada practice – which is, in effect, a philosophy or ideology – of alteration of found materials (or correction by intervention of reality) has to spill over into Dada's own productions, rendering them truly provisional, non-eternal, subject to revision. Dadaists were, of course, anti-Dadaists.

Dada was a response to a new texture of social reality, one that was infused with media, with advertisements proclaiming the wonders of products, including new chemicals and preparations. Dada's name may have come from the name of a hair lotion that was advertised in posters in Zurich during the years of the First World War. Its poster featured a strange little girl, like John Tenniel's Alice, with hair so thick it seemed unnatural and absurd. The poster proclaimed the wonders of Dada hair and scalp-strengthening headwater, which promised to improve on nature's efforts. Dada, the art movement, brought reality into the image world. It concentrated on the

rubbish of reality, the scraps and worthless bits, that which had been thrown away but did not decay. It was a form of recycling. Dada's negation aimed not only at art, but also at the social arrangement that produced art for the few and pain for the many, most obviously in war. Dada was a retort to the lies of war and the economic arrangements that made wars happen.

CHEMISTRY AFTER WAR

Gases and explosives, the new 'remedies' in warfare, new means of killing, were not the property of one side alone, and German inventiveness did not lead to victory in war. In addition, despite early profits and the benefits of technical advances borne of war's needs, the German chemical industry lost out in the peace. Foreign branches of firms had been confiscated, as had foreign patents. The Versailles Treaty had compelled the revelation of chemical secrets to the French. The war deprived the German chemical industry of its pre-eminence, but in the class war too its bosses had suffered over the years. In 1905 the working day had been cut from ten hours to nine, with no reduction in wages. During the war chemical workers had won more concessions, because of a labour shortage. In the post-war period industrialists demanded redundancies and the retraction of concessions to the workforce. Industrialists were scared of workers' power, even before the war had ended, and were terrified of expropriation. Strikes of workers, soldiers and sailors had forced an end to the war, and this effort to win the peace did not subside. A strike of 16,000 workers at Leuna, where ammonium was made using the Haber-Bosch process, managed to achieve an eight-hour day in November 1918. They also won the abolition of overtime and Sunday working and the dismissal of reactionary foremen. A workers' council of 2,000 members was formed, including white-collar employees. In 1918 the workers' and soldiers' council in Solingen called for confiscation of the chemical works at Leverkusen and the arrest of the general manager, Carl Duisberg, who had been working with the British and French occupiers to impede the revolutionary movement. At Meister, Lucius & Brüning in Hoechst a workers' and soldiers' council was set up in November 1918 – the day before the cease-fire between Germany and the victorious powers was announced – and it lasted for about a month. It oversaw economic measures: food, checking of prices, distribution of coal, welfare of returning soldiers and unemployed welfare. A *Sicherheitswehr*, security force, maintained order. All the authorities were under the control of the council. The revolutionary demands that spread across Germany in November 1918 included equal suffrage for men and women, introduction of the eight-hour day, the abolition of rules governing the relationship between master and servant (*Gesindeordnung*), introduction of unemployment benefits, improvement in health insurance and workers' councils. Industrialists realized that to regain control over the situation it was necessary to work with the workers' organs

of representation. Only in partnership with the trade unions might industry be able to institute capital-friendly arrangements. Even before the war had ended, concerns about retaining the means of production as private property were voiced by Jakob Reichert, manager of the union of German iron and steel industrialists. He asked on 9 October 1918:

How can one save industry? How can one protect employers from the threatening socialization, nationalization and the coming revolution that will affect all branches of the economy?⁵⁹

And he concluded that only the organized workers had an overarching influence. Amidst all the general uncertainty, in face of the tottering power of the state and government, industry had to cultivate the strongest force it could, and that was the trade unions. The workers' leaders would lead the workers away from revolution. But the industrialists had other friends as well. In December French troops entered the factory at Hoechst and abolished the workers' and soldiers' council. All the old forces resumed their offices, and Meister, Lucius & Brüning at Hoechst remained occupied by the French until 1930. By 1919 there was overtime once more at Leuna, along with Sunday working and piecework. Across the industry, workers were thrown out of the factories. Gone were those single men who had previously been involved in agriculture, foreign workers and prisoners of war, women who were not the main family breadwinners and those from other professions who entered the colour works only during the war. At the Hoechst factory numbers fell from 12,743 in 1918 to 7,836 in 1919. The wartime chemical industry was adjusted for peace.

In 1920 Duisberg delivered the opening speech of the main meeting of the Verein zur Wahrung der Interessen der chemischen Industrie, the organization established to protect the interests of the chemical industry. He spoke about how strong discipline needed to be reintroduced into the factories, and how piecework could act as a disciplinary measure, encouraging productivity.⁶⁰ Duisberg was opposed to the socialization of the factories on the grounds that chemists would no longer wish to research into socialized coal. The temperament of the inventor, he reasoned, is the most complete individualism and 'egoism is the motor of all progress'. For Duisberg, the opposition was not socialism versus capitalism but rather individual economy versus the socialist collective economy. And, according to Duisberg, only one had proven itself in practice. The new 'coal economy' needed inventors more than ever, but socialization crushed invention.⁶¹ Duisberg's scepticism countered that of Werner Daitz, a chemical engineer and plant manager at IG Farben, who, in 1916, had spoken of an emerging state socialism. This socialism would not cripple private economic initiative and the private capitalist economy, but would regiment it, concentrating capital in the national economy. International socialism would be devolved into national socialism,

whose election promise would be 'work rather than words'. Daitz's vision was later appreciated by the Nazis, who in 1941 placed him at the head of the Society for European Economic Planning and Greater Space Economy.⁶² Daitz's vision perhaps anticipated no more than the increasing concentration and trustification of the chemical industry, already underway. As the industry grew more compact, the trade unions buckled and permitted the reintroduction of the efficiency bonus plan. In June 1921 a trade union-backed flyer defended the reintroduction of bonuses and piece rates with the argument that otherwise there would be closures. It claimed that there were legal guarantees and restrictions on these work conditions. Despite the flaring up of resistance, a piece-rate payment system was fully in place by 1924.

By the 1920s it was 'possible to obtain dyes of excellent fastness and perfectly insoluble lake-pigments of satisfactory covering power in almost endless varieties of shades'.⁶³ But German capital's share of all this potential wealth in colour was in jeopardy. By this date there were twenty to thirty large manufacturers of coal-tar dyestuffs and a number of smaller firms spread across Germany, Switzerland, France, Britain and the USA. By 1924 the German proportion of world chemical trade fell back from its pre-war peak of around a third to one-fifth, and it produced only half of the pre-war amount of colour. But its place within the German economy was stronger, with a firm partnership between this industry and the state. With such backing, a concerted assault on workers began, for labour was one source of value that can always have more squeezed out of it.

AFTER DADA: REBELLION

In 1923 the revolutionary and former Dadaist Franz Jung was writing his documentary novel *The Conquest of the Machines*.⁶⁴ Jung surveyed a desperate scene, as the revolutionary outbreaks subsided and the usual state of exploitation resumed in Germany. Still he harboured hopes that all the disintegration might give way to class-conscious action and proletarian revolt. Weimar Germany was host to a fissured Left and a disunited working class. Jung translated that fragmentation into his writing through a modernist, montaged vignette technique. His documentary novel was part of the 'Red Novel' series, published by Malik-Verlag, which was run by John Heartfield's brother Wieland Herzfelde. Jung's narrative involved the events of the March Action of 1921 in Germany, a disastrous uprising in which Jung had participated. Before the March Action, Jung had been one of a group of revolutionary terrorists, who, in an effort to force on revolution, went out dressed as hikers to commit terrorist acts, such as setting fire to grain stocks and slaughtering cattle. At the same time, he joined the Dadaists, and produced and distributed illegal magazines together with the mass-media artist John Heartfield.⁶⁵ Jung had been an energetic participant in the revolution of 1918 in Berlin. Sent by the Spartakus-Bund to Potsdamer Platz in the centre of the

city on 9 November 1918, he acted impulsively. With a group of soldiers and bystanders, he occupied a telegraph office, but the Communist Party did not throw itself behind the action. Members of the new provisional government ousted the occupiers. Jung spent the next months holding Spartakus-Bund meetings and agitating for revolution among workers, but circumstances were difficult. Intrigue, paranoia and terror dogged the revolutionary movement. In January 1919 revolution flashed up once more, but the Left parties failed to harness the revolutionary fervour of the masses. They had no general strategic plan, and the Left was disunited. Noske put down the rebellion; and Rosa Luxemburg and Karl Liebknecht, the leaders of the German Communist Party (KPD), were assassinated. After the KPD's call to work in official political channels, the movement split, and Jung was expelled from the party in October 1919. He hitched himself to the Communist Workers' Party of Germany (KAPD), formed in April 1920 and packed with frustrated ex-KPD members. A delegation, composed of Jung and Jan Appel, set off immediately to the Soviet Union for a special meeting with the Communist International. They had no money and had to stow away on a large fishing boat. Once out at sea, they hijacked the boat with the help of the crew. Diverting the ship's course involved navigation along a mined seabed. Beyond Trondheim they had only a small map of the North Pole with, at its edges, the coasts of Norway, Russia, Siberia and Alaska. The weather was stormy and snowy, and the journey perilous, but they reached their destination. In Petrograd they spoke with Zinoviev, the Chairman of the Comintern. In Moscow Lenin met them for discussions, but he criticized their adventurism. At a second reception Lenin pointedly read aloud to them extracts from his as yet unpublished pamphlet 'Left Wing Communism – An Infantile Disorder'. The Third Congress of the Comintern exposed differences between the KAPD and other member parties. The KAPD was told to continue co-operating with the KPD in the old unions and in the democratic assemblies, and to drop the slogan 'All Power to the Workers' Councils!' They refused. Jung got involved in illegal paramilitary groups disguised as hiking clubs or sports clubs. These kept their members ever ready for the final phase of class struggle. Jung was arrested in September 1920 for the piracy action, and began to write in prison. Once released, he joined in the bloody March Action in the mining district of Mansfeld in 1921. In 1919 miners of the region had clashed with the Freikorps, the armed wing of German reaction, and had refused to relinquish their arms. The revolutionaries were strong in the area. The security police from Berlin had been drafted in to keep an eye on the workers who were engaged in wildcat strikes and, so the rulers claimed, looting and lawlessness. The workers viewed the security police presence as a provocation and declared a strike. Jung was sent there to agitate. In nearby Halle the local Communist Party leadership was cautious about calling out workers to join the strike. Max Hölz turned up. He blew up law courts and robbed banks to give funds to the KAPD. Famous for leading a



A postcard showing the BASF factory, Ludwigshafen am Rhein.

'Red Army' in the Vogtland in the Kapp Putsch days of March 1920, he raised an armed detachment of 400 men to carry out guerilla attacks on police posts. The insurrectionary wave spread, but it subsided. The workers in the chemical plant at Leuna sat in their factory for a week. The Leuna works were formed as a branch of BASF by Carl Bosch, and since 1916 had been producing ammonia. These materials had played their role in war, although Leuna workers had struck en masse for peace. In the uprising of 1921 there was no general plan. The police crushed the uprising, killing 34 workers and arresting 1,500. The army did not need to be called, for the police were able to contain the revolt. Workers fought on, but they were crushed and the struggle did not spread. It was, perhaps, indeed an episode of what Lenin called 'an infantile disorder': ultra-radical acts that failed to ignite the masses to social revolution and the seizure of the means of production. A hundred workers had died during the March Action and thousands were arrested, as also was Max Hölz. His individualistic activism was more than counter-balanced by the general passivity of large swathes of the working class. Jung went on the run in the late summer of 1921, ending up in Petrograd. Demoralization set in.

That autumn, in September, an event occurred that shocked chemical workers. At the BASF works in Oppau two huge explosions, caused by blasting a caked mixture of ammonium sulphate and ammonium nitrate, killed several hundred workers, wounded more than 2,000 and made thousands homeless. Just before the explosion at Oppau the newspaper *Proletarier* had reported on a rise in accidents in the industry. Workers were inhaling poisonous gases. They wounded their eyes or burnt themselves with acids, water or steam. And then there were harmful substances seeping into their bodies

over time. Workers struck across the industry. In Hoechst the catalyst was a comment by someone in management on the day of the accident: 'What's the big deal? There are plenty more proles left to explode.' Workers downed tools and went to the managers' building, demanding the resignation of the man who had made the remark. The managers said they had already done this. The workers returned to work. Then the rumour spread around that the man had simply been redeployed. They assembled before the managers once more and requested further information. The managers assured them that he had been sacked. At the same time, the Communists in the factory were concerned about the distribution of 12 million marks, set aside for workers' welfare. They received no answers and demanded winter aid for all the workers. Negotiations began and an agreement was reached, but the promise was then retracted. A lockout occurred.⁶⁶ Everybody was sacked.

Another crucial place of crisis was the Rhineland area, where a number of chemical factories and the coal-mines were located. French troops had occupied the southern Rhine region from the end of the war under sanctions created by the Versailles Treaty. The French government threatened to move troops to the Ruhr area, the centre of German industry, in response to missing reparation shipments. In January 1923 they moved in to occupy two-thirds of the Ruhr basin, and as a result there were demonstrations and strikes and acts of passive resistance against this military occupation, fuelled by nationalist sentiment and supported by industrialists, politicians and workers alike. The anti-French actions spread to the Rhineland. By August the French forces had killed 121 German workers. While the battles raged the industrialists continued to produce coal and sell it for cash to the French. Once these deliveries were stopped by the government the mines kept working and the bosses stockpiled coal and sometimes permitted deliveries to France. The major companies of the chemical industry, in the mini-cartel from 1916 under Duisberg's leadership, had plenty of coal in the unoccupied areas and in warehouses abroad. It was enough to 'supply dyes and pharmaceutical products to the world for another three months'.⁶⁷ In this way foreign exchange could still enter the country. And German 'wealth' continued to inflate. Credits were given to the Ruhr coal owners and other industrialists, financed by the printing of money. Salaries and expenses were paid to those 100,000 people expelled from the region or dismissed from their jobs by the occupiers.⁶⁸ In time workers and industrialists began to negotiate with the French invaders. But this was as the more general situation worsened. Unemployment grew, benefits shrunk and the German police fired on demonstrators. When, in 1923, insurrections spread across Germany, amidst massive economic crisis, the KPD, terrified of a repetition of March 1921, held off. Some tried to promote a policy of united frontism, conciliatory zag to the earlier epoch's ultra-Leftist zig. But the bloody nightmare of repression in March 1921 had left a wound on the class memory, and distrust between social democrats and Communists held sway. The fascist Right grew through

all this, feeding off resentment of the French occupiers. That was the end of hope for revolutionary change. The whole working-class movement went down.

Franz Jung had been in the Soviet Union, working in the press division of the Comintern, and then, to little avail, he worked for the aid organization helping Volga-Germans who were suffering famine. He participated in rebuilding the match industry but then was moved to a factory in Petrograd that produced iron drums. Raw material supply difficulties and economic crises made Jung's life so difficult that he fled, once more a stowaway on a boat. Wanted by the police in Germany, he invented a new identity and became a financial journalist, while also dabbling in a number of more or less dubious financial speculations. In his spare time he wrote *The Conquest of the Machines*, a reflection on the German escapades that marked the closing of the window of opportunity for internationalizing the Russian Revolution. Perhaps the March Action was foolhardy. Perhaps conditions were not ready. The action never could have been generalized: working-class militancy was localized and sectionalized, the party leaderships were inexperienced. *The Conquest of the Machines* is pessimistic in its presentation of abortive action after action, and in its representation of the failure of workers and parties to act decisively and in concert. In *The Conquest of the Machines* social progress is presented as a far-off utopia. The action is not set in one named place, for Jung insisted that there was a time in Germany when there was hardly a place where similar events were not occurring.⁶⁹ He wrote the book in response to his failure and the failure of the revolutionary movement. His conclusion was to reject parties and the trade unions, preferring instead 'red unions' and the *Allgemeine Arbeiter-Union*, a sort of German Industrial Workers of the World. In the novel it is the workers and the parties who are to blame for the useless bloody debacle at Mansfeld.

The story of the strike is prefaced by three vignettes. The first, 'Piblokto', describes a disease that affects the Eskimos. Alone in their icescape, they fall victim to a malady called 'Piblokto', brought about by fear of the future. It is to be assumed that workers too suffer from this malady, and so they fail to act. The second vignette details the horror of imprisonment in the summertime, a deprivation that Jung knew too well. And the last vignette outlines Jung's economic analysis. Electricity, 'a dangerous weapon', is pouring incessantly into the economic infrastructure, by which he means to say that governments and state no longer rule, but instead the trusts are in control. Life is changing, and most notably the pace of life is changing, as the electricity networks web across the world, and come to dictate the pace and place of activity.

After this prelude the class struggle swells. First Jung details the insurrection. Here are outlined the failures of workers to unite, the inability of the parties to act decisively and in unity, and the lack, on the part of workers and parties, of a vision of the future. Then he depicts the response of capitalist society, with bosses meeting together to plan their class struggle, which

involves siphoning off a fraction of the class with enticements and education. The tableau is one of an increasing dependency of government on capitalism and its agents, who are also eaten up by capital. Capitalism is increasingly concentrated. Monopolization is the tendency and rationalization is the trend. Jung shows how the Minister of Labour, a man from working-class origins, sells out his class, because of his fear of big business. The union officials care more about their positions than workers' jobs. Disputes develop again, for, as a Marxist, Jung knew that the struggle continues despite previous failures, and solidarity develops. It is in the course of this struggle that the workers realize that the only solution is to take over the means of production. They must conquer the machines. It is the 'red union' of the electricians that is at the core of the movement. Like the power they generate, they too are a gigantic force.

For the conclusion of the book Jung returns to the vignette form. Once more he travels into the realm of ice in an opening section called 'Awakening from the Ice Age'. It notes that it is only 20,000 years since the highpoint of the last ice age on earth. That is not a very long time and the new paradisiacal period is still a few centuries away. The final after-effects of that ice period are disappearing. We can feel the progress, the thaw in our blood. The first paradisiacal period brought about that massive growth of plants from which today's coal reserves are formed. Then came the ice age. After it there was a paradisiacal period in Europe, where the British Isles combined with Scandinavia to form a continent and the North German plain transformed into a sea. On the beach of this sea, where today Saxony is, there stood wonderful forests of blooms. The ice age came. It seems so near to us that we feel as if we too experienced it. For 20,000 years we have been frozen and now, if we are thawing, it is because we sense that we can overcome nature through labour. Jung's perspective is long-term. He gazes into the past and the future. He insists only on the present possibilities of human, that is workers', self-organization. Work will bring together people in community and co-operation. Workers' self-organization will allow the knowledge of the workers to come to fruition and put them in the position to distribute the joys of this life among themselves.⁷⁰ The second vignette, 'The Deposing of God', argues that God is a product of human alienation from nature, and he is a projection of humanity's own creative powers. God produces loneliness, separation from self and others, in short from real life in the here and now. God is anti-life. It is good that he is gone, for he was beginning to stink, says Jung. The final section of the book is titled 'The Meaning of Life'. Life's meaning consists of overcoming fear and solitude, in understanding that essential humanity lies in community. The world has changed. The pace of life has speeded up and will go ever faster. Electricity's agility provides a model for us. Age will be overcome by the desire to live. Time will be overcome by human solidarity. All will rush together into a new future. That was the dream version.

As Jung wrote these words about turbulence in class struggle, an economic crisis culminated in Germany. Less than a decade before, in April 1915, a young and idealist Georg Lukács wrote to Paul Ernst:

The power of forms seems to be constantly increasing, and for most people they seem to be more real than what actually exists. But – and this is for me *the* experience of the war – we must not concede to it. We must keep on emphasizing that the only really essential things are we ourselves, our souls, and even their eternal *a priori* objectifications are (to borrow a beautiful image created by Ernst Bloch) only paper money, whose value depends on its convertibility into gold.⁷¹

The soul is the only true thing and it is like gold, pure and authentic and detached from this modern age. But war changed much, including Lukács, who came out the other side a Marxist and stopped his talk of pure souls and metaphysics. The Great War dissolved the gold standard. As the gold standard collapsed, the British government recalled the gold coinage of sovereigns and half-sovereigns, and issued new notes. For the first time, the monarch's head appeared on British notes, and these were designed to circulate in the whole kingdom. The tangibility of gold was exchanged for the cheaply printed symbolism of the head of state. Any remaining certitude about the fact that what is stamped on a note means anything fixed was overturned much more graphically in the famous runaway inflation of Germany. From 1914 to 1924 the dollar–mark exchange rate went from just over 4 marks to the dollar to more than four trillion marks to the dollar before going back to just over four. Paper substituted for gold, and then new notes substituted for old ones at so rapid a pace that all sense of value was shattered. The German government's wartime monetary policy ditched the link between paper money and gold reserves. The inflation began early in the war, because the German government launched a borrowing programme, hopeful of swift military victory and favourable repayment conditions. The amount of money in circulation was increased and war loans taken out.⁷² Fresh legal tender was issued no longer against gold but against other pegs such as government securities. When the war was over, a beaten Germany faced debts and the demand for reparations. The new German government decided on a cheap-money policy. More and more money was printed, meaning that credits could be paid back at a fraction of their cost. The industrialists did well out of this, meeting production costs in worthless currency and selling cheaply abroad. While things held their value, currency, the symbol of value, was in free-fall. It might have seemed in those days as if the whole world was turning into paper. A. Clarke's report of 1922, *Coal-tar Colours in the Decorative Industries*, notes how, in Germany, twine,

packing materials and waterproof and fireproof overall cloth, linings, wall decorations and so on, were made of paper: the yarn and fabrics used during the war as substitutes for lacking materials were so satisfactory in terms of cheapness and durability that an extensive export business began, especially with the South American states.⁷³

Gold still held a power, of course. Fritz Haber put efforts, in the first half of the 1920s, into recovering gold from sea-water, in order to aid Germany in meeting war reparations, which perhaps he felt to some extent to be a debt on his own account. He failed, and was forced to acknowledge that the large amount of gold in the ocean was too dispersed for the process to be profitable. In the Soviet Union Lenin dreamt of gold set free from monetary uses, from exchange value, and used instead for its aesthetic and material qualities. The crimes of capitalism stemmed from the pursuit of gold as exchange value. In 'The Importance of Gold Now and After the Complete Victory of Socialism', an anniversary essay written in November 1921, he declared that 'Once we have won on a world scale, then we will, I believe, build in the streets of some of the largest cities in the world public conveniences of gold.'⁷⁴

But world victory had not yet come and so, for as long as capitalism existed on the globe, Soviet gold had to be used sparingly and sold as expensively as possible. In a world in which there was capitalism, all had to play by capital's rules. Money connected the world. If money is the link between people, then its inflation is of moral import. For Benjamin, money relates to lies. In notes for 'A Tour of German Inflation' Benjamin records an extraordinarily swift inflation.

The circulation of bank notes over many years removes the feeling of responsibility from people. The issuing of pretty colourful notes of state money encourages lies. For this nation, a period of just seven years separates the introduction of the calculation with half-pfennigs [by the postal authorities in 1916] from the validity of the ten thousand mark note as the smallest currency unit in use [1923].⁷⁵

Germany's defeat in war separates the two events. With a keen eye for deciphering the hieroglyphs of mass-reproduced culture, Benjamin calls for an analysis of the tokens that pass between people, so often unseen. What might this paperwork reveal about the state of things?

A descriptive analysis of bank notes is needed. The unlimited satirical force of such a book would be equalled only by its objectivity. For nowhere more naively than in these documents does capitalism display itself in solemn earnest. The innocent cupids frolicking about numbers, the goddesses holding tablets of the law, the stalwart heroes sheathing their swords before monetary units, are in a world of their own: ornamenting the façade of hell.⁷⁶

These little works of culture, themselves symbols of wealth, are also symbols of capitalism's self-image: self-aggrandizing, born to rule in perpetuity, as the backward glance at antiquity should prove. Yet it is also not inconceivable that, in desperate circumstances, this symbology might be shredded and redrawn. Hence Herbert Bayer's million mark, two million mark and one billion mark notes for the inflationary coffers of the Thuringian State government, designed at the Weimar Bauhaus in 1923.⁷⁷ But even these notes could not keep pace with the inflation. Was it the case that a certain antipathy was visible in his non-aggrandizing aesthetic choices? Was too much exposed by the hyper-rationalist money design as legal tender in an irrational system? In any case Bayer's efforts for capitalism in Weimar did no favours for the Bauhaus. The following February a right-wing government was put in power and it contained members who had long been keen to close down the 'Bolshevist' institute. They cut its grant by half, and slowly suppressed the Weimar institute.

Revolutionaries hoped for a new world. In actuality there was division and confusion. In the face of the drastic and confusing events of the early 1920s, Jung inclined more often to pessimism and began to doubt the possibility of progress, for us, now, soon. After writing *The Conquest of the Machines*, he gave up on imagining a utopian political future. And Malik, after publishing Jung's concoction of a book, broke with modernist writing, publishing in its place the more conventional novels of well-established socialists, such as Upton Sinclair and Maxim Gorky. The fantastical, however closely annexed to the real revolutionary upheavals in terms of its ambitious reconstitution of reality, was forsaken in favour of a realist style, that echoed in form, if not in political conclusion, the cynical surface realism of New Objectivity and its assertion of facts. Such aesthetic change appeared to mirror a new era of stability, fixity and rationalization. Facts, rationalization and stability were the watchwords of the day, and the fact was that, with the aid of us dollars in the Dawes Plan, the economy stabilized and representatives of capital assumed a new confidence. As G. F. Hartlaub, director of the municipal gallery at Mannheim and curator of a show of work of 1925 adhering to the new realism, argued: after all the dreaming and spiritualization there was a desire once more for 'the fact of the matter, the truth, reality or what one holds to be such.'⁷⁸

Communists had long had their versions of the fact, of reality, and of realism, the preferred aesthetic and philosophical mode. In 1908 Lenin used the discovery of alizarin to counter realism's antithesis, idealism, for it provided evidence of a world that existed objectively:

Things exist independently of our consciousness, independently of our sensations, outside of us, for it is beyond doubt that alizarin existed in coal-tar yesterday and it is equally beyond doubt that yesterday we knew nothing of the existence of this alizarin and received no sensations from it.⁷⁹

Lenin drew on Engels's claim in his study of Feuerbach that organic chemistry in its experiments on nature had turned the chemicals in plants and animals from 'things-in-themselves' to 'things-for-us'. Nature is made knowable. Its objectivity is eliminated. Synthetic alizarin, for Engels, refutes the Kantian doctrine of a thing in itself, which is unknowable. But in 1925, given the decay in Communist Party philosophy and politics (which decayed as its internationalist ambitions shrivelled), and its weakness for mechanism and positivism, Lukács took up Engels's commentary on alizarin combatively, for he wished to defend, against party orthodoxy, a Hegelian philosophy of praxis and consciousness. Lukács counters that Engels is mistaken. Experiments on nature, making it knowable, may produce a nature 'for us', but this is no proof of a dialectical process in nature akin to the process whereby the working class becomes conscious of itself, its constitution and its power. The 'thing in itself' and the 'thing for us' are equivalent terms, not antonyms. The opposite of a 'thing in itself' is a 'thing for itself', a thing that has gained self-consciousness. In the process of revolutionary development, it is not nature that should be 'for itself', because 'it is not alizarin that is to be brought to consciousness about itself'. For Lukács, nature cannot become for itself a subject, only the proletariat can do that. Lukács did not assimilate the methods of historical knowledge to knowledge of nature, cautious about a dialectics in nature, which had been abused to naturalize the process of revolutionary change and justify positivism. In history, the object – the proletariat – pushes towards being for itself, that is, becomes subject, as it reaches a comprehensive dialectical consciousness of the totality of society and acts consciously on the basis of this knowledge.⁸⁰ For Lukács, chemistry is a social phenomenon and, as such, is a potentially destructive force when carried out by those whose social position sets them firmly against proletarian liberation. Indeed such scientists and industrialists may represent idealist philosophical positions, in spite of their experimentation, insisting, despite their own practice, that something remains unknowable at nature's core. This Lukács derives from the essentially 'contemplative attitude' of scientific practice, which he dismisses as entrapped in immediacy and the world of appearances.⁸¹ The exploited scientist works in atomized fashion on small controlled experiments, lacking consciousness 'about the material foundations of his activity', unless he happens to be a historical materialist.⁸² Scientific practice can no more lead the researcher to consciousness of the totality than the labour process and spontaneous struggles in the workplace can lead the worker to such knowledge. And science is as trapped in contemporary ideology as any other social practice: hence Marx's observation on Descartes' conception of animals as a reflection of the period of manufacture and La Mettrie's conception of humans as a direct continuation of this Cartesian tradition.⁸³ Lukács was not disputing the fact of objective reality, but he did insist on recognizing the socially mediated interpretation of all facts. From Lukács' critical communist perspective, with its emphasis on

conscious proletarian self-activity, any sense that science was automatically progressive and on the side of universal human liberation was severely tempered.

THE FACT OF IG FARBEN: STRENGTH IN UNITY

In 1924 there was a commotion at BASF. The management announced the reintroduction of the nine-hour day. On 5 March 18,000 workers protested against the extra hour that was demanded of them. The management locked out all the workers. On 6 April they assembled in front of the factory gates and were attacked by police. More than forty were wounded and five killed. Twenty-five thousand workers followed the coffins of the five dead workers, and the demonstrations continued. The city administration of Ludwigshafen was compelled to pay out benefits, but on 9 May the chemical workers broke off their struggle and the nine-hour day was introduced, albeit with wage rises and the ninth hour paid as overtime. The chemical industry was ready to fight further. Rationalization was the watchword of the moment. At the Hoechst factory the workforce was slashed by 12,000 workers in 1923 to 5,615 in 1930.

The Communist International bulletin *Inprekorr* asked in August 1925 why such 'inhuman exploitation' was rife in the chemical industry. The report came from Leuna, and it began by stating how deeply embedded the inflation period was in Leuna workers' memories, 'when the paper money earned as wages for a shift or hour represented only a few gold pfennigs worth of the agreed tariff'.⁸⁴ And these tariffs were about half of the pre-war rate. When the gold wages were reintroduced in December 1923 the 'aniline kings' were keen to keep the wages low and several factors made this possible. German industry hit a slump, following the inflation years, and almost four million workers lost their jobs. Others were employed for only two or three days a week. Fear of unemployment was the mechanism through which employers kept wages low. The trade unions' money had dwindled during the inflation and the leaders feared the expense of strikes. During 1924 workers left the *Fabrikarbeiterverband*, the reformist union. The trade union leaders blamed the Communists, for setting up their own union and their agitation for actions that failed. The Communists charged the reformist unions with avoiding the struggle and seeding illusions in a reformable capitalism. Independent unions developed. The workers had no single representative organization. In 1925 there were hopeful signs, noted *Inprekorr*, that workers were rejoining the unions. But the redundancies continued, as the rationalized economy became the slump economy. While the workers were divided or dismissed, the chemical industrialists clung ever tighter to each other. In December 1925 the major German chemical companies joined together to form the chemical cartel IG Farbenindustrie AG. Carl Duisberg had advanced the idea of a combination of the leading companies since before the Great

War. BASF, Bayer, Meister, Lucius & Brüning, AGFA, Griesheim Elektron and Weiler-ter-Meer were unified. This was the next logical move after years of concentration. IG Farben formed the largest concern in Europe and the largest chemical concern in the world, producing in its various branches colours and dyes in all varieties, pharmaceuticals, photographic materials, artificial silk, nitrogen and cellulose products. The whole German colour industry was one vast monopoly, rationalized and concentrated. The following year more industries joined. The artificial silk and inorganic company Köln-Rottweil joined and furnished contacts to its British and American partners, Nobel Industries and DuPont-Trust. Various dynamite factories were also included, as well as celluloid manufacturers. As part of the quest for synthetic benzene, mining companies were incorporated and a partnership with Standard Oil in the US was formed. The vast enterprise agreed price, profit and cartel regulations. Duisberg did not only forge the cartel. He also supplied ideology. Articulating frustration at the Allied military occupation of the Rhine, he forged a link between industry, *Volk* and state, drawing on nationalist sentiment.

German economic life has its strongest roots precisely in the soil of the Rhine, whose population has defended its Germanness with toughness and with a willingness to sacrifice. This summer the Rhineland celebrates a thousand years of political affiliation to the German empire. The meaning of this celebration is the powerful acknowledgement of insoluble national community [*Volksgemeinschaft*]. The thousand-year celebration should be a sign to the world that the Rhineland is German to its core, its inhabitants are closely linked together with the totality of the German *Volk*, with German culture and German economic life.⁸⁵

The following week Duisberg continued with the theme of the Germanness of the Rhine where so many of the chemical factories were located.

‘We want to be and remain German, we here on the Rhine’. And how do we transpose this, our holy conviction, into deed? For all of us here, all of us who belong to the Reichsverband of German industry, the deed means more to us than the word. The German deed, born of hard, unbending work on a strict scientific foundation, sings to us from a thousand wheels and machines, precisely from the banks of the Rhine river, the powerful *Songs without Words*. – Of course this song no longer sounds as it did before. Full of deep sadness, we see that much is out of action and senselessly destroyed by the hardest treaty in the world, the so-called Peace Treaty of Versailles. And still it is not enough for those who dictated this treaty to us.⁸⁶

Duisberg insisted that Allied demands for disarmament were absurd. Germans had disarmed and so it was implausible to imagine that Germany would wish to wage another war. And even in 1914, noted Duisberg, Germany had not been prepared for war. He reminded his audience that 'what made Germany great and powerful were its deeds of peace'. Peace and greatness come through labour. Duisberg cited Friedrich the Great: 'The people are made for work and my *Volk* must work'.⁸⁷ Duisberg referred to the 'Gospel of work' and noted that 'work brings blessing'. He advised the trade unions to work together with the employers to raise productivity, and to concentrate less on questions of wages or the length of the working day, because labour is a 'blessing'.⁸⁸ The people must work to build up the industry, to make German capital powerful. Like Henry Ford, he noted, the industrialists have a responsibility to solve the social question, for this was their 'most noble duty'. But there was no doubt that the 'burdens' of wages, taxes, freight costs and social-political costs must be limited. The colonies were lost, and the treaty conditions could not be evaded. 'Our capital melted like snow in the sun, our economy has lost its blood'. All must pull together. One company, one will. Duisberg had a proposal for how this galvanized entity could be forged. In a speech to industrialists on 23 June 1931, where he noted the 'process of consolidation of our economy' and the need for 'massive sacrifices from all circles of the *Volk*', he announced:

Incessantly the German *Volk* calls for a leader [*Führer*], who will free it from its unbearable situation. Should a man come now, who has proven that he has no inhibitions, and who is of a mind to direct the spirit of the front generation towards the peaceful work of liberation and to make this a reality, then this man must absolutely be afforded succession.⁸⁹

The last democratically accountable German government was removed from office in 1930. A 'Grand Coalition' government headed by the SPD came to power. It attempted to cut welfare payments in the face of mass unemployment. Despite its forceful measures for capital's benefit, the President, Paul von Hindenburg, made plans to overthrow it, in the interests of forming an anti-parliamentary and anti-Marxist government.⁹⁰ The Grand Coalition collapsed when agreement could not be found on the SPD proposal to increase employers' contributions to unemployment funds. Hindenburg used Article 48 to install a new Chancellor and to govern by emergency decree. IG Farben thrived against this backdrop. In 1926, 44 per cent of world colour production was German, but in the period 1928-32, after cartel contracts were made with Switzerland, France and Britain, mass redundancies and new technologies introduced, the percentage rose to almost 65 per cent.⁹¹ Thousands of workers were sacked, with the largest numbers dismissed from Leuna. While thousands were discharged, profits held strong. IG Farben felt so confident that it built for



A postcard showing IG Farben's Frankfurt headquarters, mid-1930s.

itself a beautiful building in Frankfurt. Hans Poelzig was the architect who won the competition to build a high-profile administration block in 1928, and it was completed by 1930. The building was functionalist in style. Every aspect of it exuded rationality and efficiency. Its inner steel frame determined its form and its façade lacked all decoration. Inside were all the most modern conveniences, such as readily available hot water, mechanized ventilation, telephones, lifts for files, and garbage-disposal units. The walls were painted in IG's new paint, Caparol. The building was built for flexibility, in case uses or personnel changed dramatically. The linoleum was jointless, the electrical cable shiftable, the walls partitions, sometimes of glass.⁹² The modernist wish for transparency and the joy in artificial light had become a way of organizing the adaptable office space, a way of allowing supervisory control of a rationalized workforce. When the day's natural light was gone, artificial light flicked on to standardize the length of the working day. The daily work routine of its 2,000 employees was rationalized and mechanized. The utopia of light and glass is made banal in office space and a smoothly rational world of muted supervisors' movements and automatically flowing documents. The lift, the moving staircase – were wish-images or ideological fixes, for they allow the effortless movement of which Scheerbart dreamt, but here it becomes a social fantasy, annexed to the slick movement promised to those rising from the ranks of the proletariat to the ranks of the white-collar employees.

ARTIFICIAL LIFE AND LIGHT

Siegfried Kracauer charted this culture of rationalization quite precisely. No one has a more melancholic view of rationalized city life than Kracauer. In

essay after essay, in particular his journalistic sketches, he speaks of desolate urban themes, with crowds leading fake lives, unfulfilled existences, avoiding recognition of their utter desperation through pop songs, alcohol, light shows, revues and films, which present a complete sensuous assault.⁹³ His object of study was not the mass of factory workers, now demoted, for they are insignificant to the present moment. His study focused on the administrative staff and sellers of new goods, artificial silk and glamour. Their city lives endure through attachment to the spectacle, which just about holds city dwellers teetering on the edge of the abyss. Modern city experience is fully inauthentic, superficial. Everything in the city is geared towards preventing recognition of any 'higher' meaning, in a spiritual sense, as well as blocking the formation of any political collective that would set an aim or a goal for life, a self-consciously chosen collectivity that could make decisions about collective futures. Instead of self-motivation, self-activity, there is only drill, its automatic movements as automatic as the new machineries of the workplace, operating under *Diktat*, under 'an unseen but inescapable command'.

A feuilleton piece called 'The Revues', written in 1925, presents a scene familiar in Kracauer's journalism.⁹⁴ The title makes reference to an entertainment form that flourished in German cities in the 1920s. The revue included short scenes or numbers, maybe 60 in an evening, sudden changes of mood, stage set and theme. These were huge affairs: in the 1926–7 season nine revues played nightly in Berlin to 11,000 spectators.⁹⁵ Kracauer typically saw the revues as translations into aesthetic play of the two major drives of the age, industrialization and militarization. 'The Revues' imagines the girls on the stage as if manufactured by Ford.⁹⁶ But in addition to the conveyor belt of mass-produced identical girls, there was another image, the image of soldiers marching to war. The word revue was of military origin, referring to the inspection of soldiers on parade. The revues made clear their military connections, their debt to the wars that had been, and those to come. (After the Tiller Girls, the Hiller Girls of the 1940s exposed this to a ludicrous degree with drills and marches.) Kracauer notes the uses of history and nationalism as themes of the revues. In their line-ups, it was as if the girls shouldered rifles on stage, and sometimes they did. Theirs was a drill, as Alfred Polgar observed:

Another magic besides that of the erotic emanates from the appearance and the actions of the Girls: the magic of the military. Drilled, parallel, in step, correctly executing handholds and manoeuvres, obeying an unseen but inescapable command . . . it provides the same appeal that makes soldiers' play so palatable to the spectator; but of course only as a spectator.⁹⁷

In similar language Walter Benjamin, in one of two reviews of Kracauer's study of 1930, *Die Angestellten*, assesses the character of the white-collar

workers who flocked to these events. For him, the white-collar employees represent 'a new, more uniform, stiffer, more drilled petty-bourgeoisie'. But Benjamin goes on to note the peculiarly fervid inner life of this rigid outer typology, writing 'It is infinitely more impoverished in terms of types, originals, eccentric but conciliatory human characters than the old class now passed away. Instead though it is much richer in illusions and repressions.'⁹⁸

The diagnosis from the critical theorists is homogeneity, on the stage, where the Girls are as if mass-manufactured by Ford, and in the audience. But, at the same time, such conformity provides an expansive backdrop for so much wishing, desiring, daydreaming and self-delusion, as Kracauer outlined again and again in his forays into city lives.

Ernst Bloch recognized what Kracauer was attempting to map. It was, as he called it in his review of Kracauer's *Die Angestellten* ('7 White-collar Employees'), the 'artificial middle' (*künstliche Mitte*).⁹⁹ As Bloch puts it, Kracauer penetrates this middle space, while others only observe. It is the space of ghostly white-collar workers in the empty everyday, haunting their locales and rooms. Bloch and Kracauer also called this the 'hollow space' (*Hohlraum*), a spiritually cavernous space chock-full with distractions and fads. The reference is architectural, just as is Bloch's connected notion of a class of people structured or, more aptly, unstructured by a *verschollene Innenarchitektur*, an absent inner-architecture. The hollow space allows for vertiginousness, hedonistic gratification amongst the bedazzle of fleeting impressions on the streets and in the entertainment extravaganzas. Here, remarks Bloch of office-worker culture, in an essay of 1929 called 'Harsh Night in Town and Country': 'Die Mitte ist buchstäblich irre geworden', the middle has literally gone mad.¹⁰⁰ The middle is the place of the self-defined middle classes, those with relatively clean hands who staff offices and shops and who mediate commodities, rather than being their primary producers, and they have a middling culture that is neither high nor vulgar. But their middle is also a conceptual middle. It is a space between the world of appearance and the world of truth, a truth that threatens not to reveal itself, not to reveal the passage from one realm to the other and so to leave these new super-modern people stranded in the void between. This middle is expanding, and so the new socio-philosophical concern with it is justified numerically. It has quintupled itself, while the industrial workers have only doubled in number.¹⁰¹ The city of daily greyness and glossy neon evenings belongs to the *Angestellten*, the white-collar employees. These crowds are empty inside and must be filled up by 'zerstreutes Leben', distracted or dispersed life. These hoards colonize the middle but are slight in form, being only shadows of flesh and blood beings, wiped out by fears: fear of redundancy and uncertainty of existence, fear of ageing in a age that fetishes youth, fear of becoming a proletarian, fear of revolution and fear of death. The curious thing about the middle is that though homogeneous it is not communal. Kracauer slips into their streets in certain parts of Berlin, which are geographically

close to Red Wedding and Neukölln, where there are Communist taverns and a class-conscious proletariat. Unlike the city's red zones, in the streets that belong to the middle, people are dispersed, atomized. In 'Scream on the Street', of 1930, Kracauer writes:

There people do not belong together, and the atmosphere, in which communal actions could be undertaken, is totally lacking. They expect nothing from one another. Uncertainly, they spread out, without content, empty.¹⁰²

This empty middle, the hollow space, is flooded by the bric-à-brac of societal dreaming and desire. This fuzz and fizz of life was available at cinemas and at the revues, where could be found new and typically urban-modern modes of entertainment and spectatorship, both covered by the term *Zerstreuung*, which more literally means dispersal as well as distraction or diversion. The public enjoys and longs for this dispersal, he says, because the public must not collect, it must not collect itself into one. If it were to collect, then there is no saying what it might do. As Kracauer puts it in 'The Revues', 'Out of boredom, it might cause riots.'¹⁰³ And that is why the police disperse the crowds whenever they gather on the streets, for the police know that the streets are meant for traffic, for unceasing flow. In another essay, of 1925, 'The Artist Now', Kracauer writes about the street again.¹⁰⁴ Like Franz Hessel, Kracauer spends much of the 1920s 'botanizing on the asphalt', as Walter Benjamin phrased it. 'The Artist Now' observes that the street is perfectly represented by film, a fact substantiated by the vogue for so-called street-films. Kracauer analyses Karl Grune's film of 1923, *The Street*, an Expressionist film about a man who abandons a dull petty bourgeois existence for the enticements of the street, where he is robbed and framed for a murder. Suicide results. Kracauer notes how this film enacts the contemporary truth that people on city streets have no relationship to something 'up above'. They are simply an externality, just as is the street itself, on which there is so much activity, but nothing really happens. The bustle of figures is like the whirl of atoms: they do not meet, but rather smash up against each other. They repel each other but do not separate. Love is a coupling, murder a coincidence. This is a swarm on the asphalt, a soulless next-to-each-other of steered cars and unsteered drives. Instead of living in connection with things, people sink into deadened objects: into the cars, the stretches of wall, the neon advertisements, which, irrespective of the hour, light up and extinguish. The self, it would seem, has become fully citified.¹⁰⁵ Nature is not unchanged. In a subsection of 'Words from the Street' of 1930, called 'Nature Garden', Kracauer speaks of the shrinkage of nature in the city.¹⁰⁶ Nature proper is replaced by 'a city nature with its primeval forest streets, massive factories and roof labyrinths' whereby the little oasis of a well-advertised 'nature garden' tucked behind a restaurant carries over the original word

'nature' only as a 'tiny poignant language-ruin jutting into the weekend of the present'. It is this new, citified, post-natural second nature that is absorbed by film, as well as photography, which reproduces this estranged nature, as Kracauer argues in 'Photography' of 1927.¹⁰⁷ In 'The Artist Now' Kracauer notes that every film gives an image of the present, and that is part of its 'justification'. And this image of the present shows one thing above all, a city street, or more specifically, as Kracauer puts it: 'the power of forces which distort the world today into a city street'.

The flow of the streets is not just represented on film or even by film's movement through the projector. It is also reproduced inside the cinemas where an urban experience was guaranteed. For example, in the entertainment complex 'Haus Vaterland' there was a cinema. There had to be, for cinema was killing the old-style revues and the only way to claw audiences back was to incorporate the newer attractions into the older ones. Cinemas marked their newness in their very architecture. *Neues Bauen*, new building, was practised here. One of the aspects of the new gigantic cinemas built after 1925 was the egalitarian seating arrangement with no ranking in the seats' points of view, reflected in Kracauer's 'Cult of Distraction' (1926) in the phrase 'the homogenous cosmopolitan audience, in which everyone has the same responses from the bank director to the sales clerk, from the diva to the stenographer'.¹⁰⁸ Haus Vaterland's cinema was designed by Carl Stahl-Urach, who had designed the set for Fritz Lang's *Mabuse, The Gambler*, in 1922, and it was a good example of 'new building'. Hans Poelzig, architect of the Berlin 'Babylon' cinema in 1926, observed that cinema construction was the only type of building that a cash-conscious society dared construct. It guaranteed large returns. The hanging steel construction in Haus Vaterland's cinema made it possible for the upper circle and proscenium to form a single round shape, circled by illuminated bands and reflected in a mirrored ceiling. The circulation of traffic outside on Potsdamer Platz, reputedly the busiest traffic interchange in Europe, was reflected into the building via this curved form. This is of more than formal importance. Old forms of perspective associated with theatre are dashed in cinema. Apart from a gesture towards equality, the traits of circulation, movement and dynamism are evoked by design elements. In addition, light became an integral part of the ensemble. Light swamped the auditorium's scenery with colour; it redefined shapes and form and spaces. Light was a new material for architects. Erich Mendelsohn produced day and night versions of his architectural models and sketches. Mendelsohn designed Berlin's Universum cinema, which was a palace of light inside and outside, where floodlights, special effects and signage twinkled in the evening. In 1926 Mendelsohn's *Amerika* appeared, in which he wrote of New York's Broadway and its night-time mysteriousness, intoxication and glitter, which dissipates by day. By day Mendelsohn's photo shot of Broadway captures only a tangle of dead neon words and signs from sky to ground.¹⁰⁹ By night

flared up Broadway's 'flame-like writings', and 'the rocket fire of the moving illuminated ads, emerging and submerging, disappearing and breaking out again'. This new and 'grotesque' architecture is disordered and exaggerated but 'full of imaginative beauty which will one day be complete'.¹¹⁰ Mendelsohn's Broadway appeared in a jogged photograph of doubling light trails and outlines, intensifying the confusion. Words in light echoed each other: Coca Cola, Candy, Central Theatre, Jackie Coogan, Dancing, Dining, Musical Review. Light was the matter of cinema too. For the opening of the Universum Kino in 1928, Mendelsohn wrote a short poetic text. It declared that film is the 'theatre of movement' and 'movement is life' and it could relate to 'actual life', which is 'genuine, simple and true'. In the Universum, the whole world is repeated.

Picture screen – the outside world.

Film image – colourful life, tears, circus and ocean moonlight.

We spectators – a thousand, two thousand lenses [*Objektiven*], which suck it all up and reflect it, are happy or have experience.¹¹¹

The audience becomes part of the mechanism of the cinema, a point of photographic absorption and a reflecting lens. Light makes this architecture and this experience. The lights on the cinema's façade draw the public into the auditorium where all surfaces, curves, organ tune rolls and waves of light on the ceiling flow towards the screen, and through the medium of music, into the flickering image and thereby into the Universum, or universe.¹¹² Light was the point of entry into everything. The screen is transparent, a window onto a world of action. The cinema is transparent, with no pretension, a super-modern space. This is a space of fantasy composed of colour and light. Artificial light douses the night world of the 1920s and early 1930s. Neon advertisements, the twinkle of light architecture or firework displays all play a role in what Kracauer sees as a game of distraction and separation. Light is devious. Luminosity in itself only makes blacker and more opaque the surrounding darkness, the ground dissolved against a dominance of surface. For Kracauer, the illuminations of all sorts bathe the crowds in a glistening dew, making them a surface of play, and, through this very play, they divert crowds from seeking any further meaning. *Die Angestellten* observes Kempinski's establishment at 'Haus Vaterland', with its themed rooms, such as a Turkish café, a Spanish bodega with Romanesque vaulting, a Rheinterrasse café where an artificial storm raged every hour on the hour and a Wild West bar where the waiting staff impersonated cowboys and geisha girls. Streams of light are an integral part of these ensembles. They are beamed across the room, in colours as bright as parrots, and they douse Romantic motifs, such as the Heidelberg castle, with a blaze of colour, which the sinking sun would be incapable of imitating. It seems almost as if, once the day comes and the light is switched off, the clubs no longer exist:

Evening after evening they arise anew. But the real power of light is its presence. It alienates the masses from their habitual flesh, casts over them a costume that transforms them. Through its mysterious force, glamour becomes substance, distraction stupor.¹¹³

In 1925, in 'The Artist Now', Kracauer notes that it is artists' task to represent the emptied world, the external life that appears, and that has no face and no content.¹¹⁴ Film, as thin strips of light and shadow play, is the perfect rendition of this surface of reality. It peels off the substance-less surface. It represents 'the world of appearance', and especially in terms of glamour and distraction. For Kracauer, the hope is that such stark and excessive representation may make the surface so shiny, so polished, that it flips into something else, so shiny that it is made available for reflection. But this is a gamble.

In a review of 'White Collar Employees', Walter Benjamin notes how there are *Bilderwitze*, picture puzzles, in Kracauer, which, despite or because of their Surrealism, sum up 'social reality'. One such is the Bengal Lightshow in the Lunapark, which on a weekend evening glows red, yellow, green, delighting the white-collar workers, mesmerized by the quicksilver water-dance. And yet, once the display is ended, the wounding recognition can be sensed that all the swirling, crystalline patterns of water, shot through by coloured beams, gash from meagre capillary tubes. These startling flashes of delight dazzle and blind, but perhaps they might produce a brilliantly lucid vision in the audience's identification of the connections between their own white-collar drudge lives and the momentary distracting pleasure that is produced cheaply, mere spectacle, and yet that speaks of, that lets gush up, so much lively potential.¹¹⁵ More often, though, the lights are complicit in the lie. The lights in the streets, in the revues, in the cinemas, distract, rouse and prevent contemplative musing. They force crowds into the clutches of the culture industry, which shines more brightly than anything else they receive. In 'Picture Postcard' of 1930, Kracauer writes of the ways in which the lights of the neon advertisements bathe the Kaiser Wilhelm church in the centre of Berlin's West End in a glow that replaces any divine type of spark or illumination. In the same sketch he writes of:

The glassy columns of light, as tall as houses, the bright overexposed surfaces of cinema posters, a tangle of gleaming neon tubes behind mirror panes collectively undertake an assault against the tiredness, which wants to crash in, against the emptiness, which must be avoided at all costs. They bellow, they drum, they hammer on the crowd with the brutality of madmen. This is all an uninhibited spark, which not only serves advertising, but is also self-serving. But its swinging and circling is not merry like the illuminated advertisements in Paris, which satisfy themselves by forming their intertwined patterns from red, yellow and lilac. It is rather a flaming protest against the darkness of our existence, a

protest of a lust for life, which as if of its own accord ends up in the desperate acknowledgement of the pleasure industry.¹¹⁶

Lights are screaming. New light sources were proper to the white-collar employees. From the 1920s there was neon in the cities, screaming advertisements and advertising entertainments. New types of light were developed for department stores, entertainment complexes and, most importantly for the routine everyday, offices. Studies in the 1920s and '30s asserted a link between lighting and the productivity of workers. *The Science of Seeing*, by Matthew Luckiesh, director of the lighting research laboratory at GEC, Cleveland, and Frank Moss, a physicist at GEC, made the case for brighter lamps in homes and offices, and analysed in great detail the pre-conditions for 'visual efficiency and ocular comfort'.¹¹⁷ By the late 1930s fluorescent light, with its low discharge of heat, made possible a great increase in interior floor-space, and the light itself made bright walls and very bright horizontal surfaces, essential for the daily work of reading faint carbon copies and pencilled marginalia.¹¹⁸ The light that shone everywhere, illuminating night and improving day, was supposed to make secrets impossible. It was to contribute to the new sum increase in objectivity. The newly objective realms that Kracauer investigates in order to diagnose the present and future of German society are so well lit that, like the nose on a model's face in a glamorous photograph, there is apparently nothing to see. It is not just light that has this effect. Revues, like illustrated magazines, are so full of pictures that we see nothing. People, he claims, get too worked up if they actually notice something.¹¹⁹ But that does not mean that there is nothing there. As Ernst Bloch put it of New Objective culture, in 'Transition: Berlin, Functions in the Hollow Space', 'It has its ornament by not having any at all'.¹²⁰ The blinding glare of new light deceives more than it illuminates. The intense and ubiquitous illumination of artificial light chased out the over-cluttered, musty and dust-gathering petty-bourgeois interior of pre-Weimar, which had been doused in gentler gaslight or flickery early electric forms. Kracauer mocked that dusty past in 'Today's Furniture' of 1931,¹²¹ but hopes that the remaining starkness reveals not simply its slickness but also, at the very least, the continued harbouring of yet more intimate and suppressed secrets, if not the secrets themselves. In 'Today's Furniture', after his descriptions of sleek, hard-cornered wardrobes, chairs and tables in the New Objective style, a reticent bulk, Kracauer notes that just as dusty old furniture of a previous style era is laughable now, these new forms will be 'seen through' in time. 'Inside them too ghosts rumble around, which no vacuum cleaner can scare off'.¹²² In the interior of rationality lurks a bad magic. Seeing through to the ghosts already forming in the now is Kracauer's ambition. Seeing, amounting to a methodology of looking attentively, is the only way in which the ghosts might be brought into the visible spectrum.

Take Dodo, a ladies' man in a night-club, observed by Kracauer in 1925 as he dances and flirts and gets knocked back and then charms another woman.¹²³ Dodo, comments Kracauer, is a zephyr with a raspberry smile. His continual starting from zero, with its edge of cheerful desperation, is a mechanical, zombie-like repetitiousness. Kracauer watches him, as he always does. Kracauer is an observer, and also an interpreter: no New Objectivist he, he is a witness. He is not separate from that which he describes. He does not stand above it, but he does appear to gain glimpses into the other side, as do drunks or dancers or fairground crowds, at sudden moments. 'The Forbidden Look' of 1925 is a sketch about such a moment of insight.¹²⁴ Kracauer tells us about one of those city pubs, of which there are many, where adolescents cook up more or less exciting plots about fame and fortune, housewives of indefinable age perch on benches next to dubious spouses, and now and again, alone in a corner, a tart slumps, dozing in front of her glass of beer. In just such a pub night after night a phantom appears:

In itself the locality is not odd in any way. The photographs of the yearly fair on the walls, which resemble to a hair the faces of the guests, suck, vampirelike their souls, artistes of third and fourth grade celebrate in the midst of the general lifelessness their paled arts, and in a lantern above their heads, an anatomical preparation sways, which turns out, on closer inspection, to be a stuffed eagle-owl. The waiter in tails increases the sadness of the image, for his properly white shirt front spreads a gleam, which awakens the illusion of a higher world and exposes the poverty of the existing one without mercy.¹²⁵

Here Kracauer relates a glimpse into a submerged world. He goes on to speak, dreamlike, of a pianella, an automated music machine, in the pub. This technological monster of reflectors, lights, sounds and shapes begins to play. It transforms itself into a mirrored room, illuminated by a thousand bulbs. Inside this room young men and women dressed in costumes from the past dance in a ring. Suddenly, watching this, Kracauer startles awake, or rather, as he puts it, 'a veil is torn away' and 'the phantom appears'.¹²⁶ It brings about the realization that we too are dolls, puppets, always turning in circles, carrying dead epochs around with us. You look back over the world that you have left behind, in order to see from this other vantage point. It is 'as stupid as an oleograph, weak as coloured shards of glass'. He writes:

In that glassy phantasmagoria you read the symbol, and, dead in the boundlessness of the hollow space, you renounce all the happiness that you ever possessed and never again will possess.¹²⁷

To acknowledge this is dreadful, but it is also a starting point. In 'The Artist Today', Kracauer called those who inhabit the city streets 'nihilists', who

‘demand the revelation of the negative’. To them ‘the excesses of technology seem more real than soulful principles’. They emphasize the negation.

They believe that America will only disappear once it has fully discovered itself and they see the emptiness of the streets even there where decorations and bay windows disguise it idyllically.¹²⁸

These nihilists demand reality. They desire it, as Kracauer claims in ‘Travel and Dance’ of 1928, seeking ersatz modes of expressing a lust for experience of the infinite and eternal, reality’s co-ordinates.¹²⁹ Despite the searching, the pull towards the void is the determining reality for them, although they constantly seek a connection with the *Obere*, the above. ‘The Artist Today’ insists that filmgoers attempt, because they are human, to cross a gap, the gap between what Kracauer terms ‘film image’ and ‘prophet’s speech’, between the unreality that is contemporary reality and the higher reality behind appearances, which threads through the everyday but is only caught in glimpses. If no connection is made in any way to the other side, to the higher reality, then there is, says Kracauer, only a hole (*Lücke*), ‘the middle is unbuilt’. Revealing his own stance, as well as the injunction to everyone else, he writes: ‘Only once the reporting of real things turns into participation in them, does the apparent reality fade’.

SURFACING

In all of this what is apparent is just how much Kracauer saw the mid- to late 1920s as a time of foreboding and desperation, and not one of a liberation and joy silenced by the clampdown of 1933. That this was a world in crisis was evident beneath the glamour, or because of the glamour. Its signals were alienation, isolation, fear, addiction to illusion. The portents of a disaster to come screamed silently, for Kracauer, but there was also always a possibility for reorientation, for genuine life – be that in the revolutionary reconnection of social relations or in the theological reconnection of realms. New forms of technological culture made it harder and harder. Film, for example, became ever more consolatory, ever more glued up with the untruth of sentimentality. In ‘The Revues’ of 1925, Kracauer had noted how film cushions the sensibilities, a racehorse falls, but in slow motion and so gently. Bombs damage painlessly.¹³⁰ Film will, in time, comfort all too much. In 1937, in ‘Aesthetics of Colour Film’, Kracauer tells how film has pursued certain directions above all. He tells us that, apart from the inventive and implausible colour schemes of Disney cartoons, colour in the movies is a dead ballast, making the nature look as if it has been painted. Coloured film is a lie posing as truth. Colour becomes a drapery that, like neon light, has the tendency to obscure more than it reveals. Black-and-white film could capture the blue distance better than a film that seemingly reproduces the blue of the distant mountain range.

Artifice masquerades in the garb of the real. Colour has come to replace montage in film. Kracauer observes how once colour came filmmakers abandoned montage, satisfied as they were with the illusion of flowery meadows. With the loss of montage went the loss of de-familiarization, and this flattening out threatened to obscure the separations and the connections between essence and surface. Pudovkin's representation of the façade of a Tsarist court building looks nothing like a postcard of the same, but it has gained *Sprachgewalt*, 'the power to speak'.¹³¹ Without colour, film was compelled to be independent of the object. 'The fewer the connections to the surface' the less effort is needed to abstract. With colour, there is no 'act of sabotage against the conventional connections between phenomena'. Now all is surface without rips, without tears in the fabric of the fantasy. The gamble has not paid off. Film worked on the masses, rendering them half-conscious and atomized in their numbers. This art of light gave 'substance to glamour and distraction becomes intoxication'. Financial crisis hung over this social world as threat. Even the *Frankfurter Zeitung*, for which Kracauer wrote his vignettes, almost went under in 1929, but laundered capital, stemming from IG Farben, saved it. There was a price to pay for this. The editorial line became noticeably more pro-industry, and Kracauer was edged out.¹³²

Kracauer described the distracted culture of the white-collar workers as a flight from revolution and death, but, by the 1930s, they received, one way or another, an excess of both. Truly, many others had to die for the Reich's revolution, a perverse revolution that kept property relations, at least for non-Jews, intact, but the white-collar workers took their share of death, in time, in the pummelling of the cities by Allied bombers. They lost those blinding glaring lights, only to have them replaced by another drama of night-time illumination. This illumination dressed itself in natural garb: the red light of torchlight rallies, or even the spectacle of the burning Reichstag, a signal to begin the wipe-out of metropolis neon, in order to replace it with necropolis pomp, and the extension of the automatic *Diktat* and military drill.

Nazi Rainbows

SYNTHESIS IN THE REICH

On 20 February 1933 the cross-shaped logo of the firm Bayer was switched on above the IG Farben factory at Leverkusen. The huge logo, 70 metres in diameter, twinkled in the night sky, the largest free-floating electric-light advertisement in the world at the time.¹ That same day the former Reichsbank president Hjalmar Schacht invited leading German industrialists and financiers to a meeting at Hermann Göring's home. In the elections of 6 November 1932 Hitler's NSDAP had lost seats in the Reichstag, while the Communist Party had gained.² But on 30 January 1933 Hitler was named chancellor and head of a coalition government. Another election was announced for 5 March. The meeting was called in order to raise funds for the campaign. Schacht wanted 3,000,000 Reichsmarks. Baron Georg von Schnitzler, a prominent IG Farben man and bearer of the honorary rank of SA-Hauptsturmführer since 1930, represented IG Farben at the meeting. He promised 400,000 Reichsmarks, the largest donation, and the equivalent of the monthly wage of 1,600 skilled workers, 'so that it might be the last election'.³ Shortly before the election the Reichstag burnt down and an emergency law was passed to restrict any activities on the part of the Communists, who were accused of arson. The Nazis had success in the March election, gaining 5.5 million votes. Hitler was re-affirmed as chancellor and an Enabling Law giving full powers to the government was passed. Bayer's pharmaceutical department sent a memo to its sister firm in the USA, Winthrop Chemical Corp., offering a résumé of the economic and political situation in Germany. It noted: 'The old parliamentary system has lost breath in the competition of political ideas and had to make way for the idea of political leadership.' It continued:

The Reichstag fire gave the signal for the domestic fight against the Communists and Marxists who were setting about bringing Germany once more to the edge of the abyss through armed uprising. With an iron fist rigorous action was undertaken and the land cleansed. The *Volk* were granted peace.⁴



The Bayer Kreuz
above the factory at
Leverkusen, from
*Erzeugnisse unserer
Arbeit*.

A power station in
Halle, Germany, from
an illustrated book of
1933, *Deutsches Land in
111 Flugaufnahmen*.



On 20 March 1933 the first concentration camp was opened. It was at Dachau, and Carl Bosch welcomed the camp built to house 'depraved unemployed youth', who would be re-educated into happy people who 'are proud of their work'.⁵

IG Farben had a troublesome association with the Nazi Party. In 1931 Hitler attacked concerns that were deemed to have high Jewish participation in management. IG Farben was a target. The concern was mocked in cartoons, personified in Jewish stereotypes named Isidore G. Farber or I. G. Moloch.⁶ Once the Nazis were in power, tensions existed over the animal testing of drugs, which the Nazis outlawed, and the continued presence of Jewish scientists, which appalled Hitler. Jewish scientists were immediately alienated across the Reich, and even the prominent Fritz Haber, a Jewish convert to Christianity, was compelled to resign as professor at the University in Berlin in 1933. IG Farben entered into discussions with the Nazi leadership on questions of the National Socialist economic programme. Through personal contacts, salons and meetings, a capitalist programme was worked out for the Nazi regime, and it was one on which capital and state could agree. It took account of the collapse of the world trade system in the crisis of the early 1930s and proposed plans for a *Grosswirtschaftsraum*, a 'greater economic area', in which German industry could become self-sufficient. Rearmament guaranteed the future plans for geographical expansion. The European landscape was opened to German industry and its military protector.

In August 1936 Hitler delivered a speech on the Four-year plan for the economy. He noted how there were only two states in Europe that had made a stand against Bolshevism: Germany and Italy. Other countries were either perverted by their democratic way of life, infected by Marxism, and therefore soon to collapse, or they were ruled by autocratic governments, whose only strength was military. Not one of these countries had been able to wage war on Soviet Russia. Germany, he insisted, had to rearm and it had to mobilize the Volk politically to equip them for this task. To this end the living area needed to be expanded, in order to boost the raw materials and nutritional basis of the Volk. The German army had to be ready to fight in four years' time. The German economy had to be ready for war in four years' time.⁷ The economy was reoriented towards preparation for war, while industrialists anticipated the booty, the markets, the profits and the labour power that would fall to it once the conquering of land was under way.⁸ State and capital were a mighty union, and their combined force seemed powerful enough to move mountains, that is, to change the landscape, to work on nature itself, that once seemingly eternal presence.

In the First World War the very air had become a resource for explosives, as nitrogen was snatched from the atmosphere and processed. In that war nature had failed the German war effort, and science had been forced to substitute itself. Without rubber there could be no tyres, no electrical insulation, no balloon fabrics, no hoses, no engine packing, all necessary for industrial,

marine, naval and air equipment for the mechanical epoch after horse power. BASF had tried to meet this need in 1917, manipulating hydrocarbon molecules, but the rubber produced was a poor hard substance. The quest to turn coal into rubber as well as into oil continued.⁹ It was this mutual desire that brought Hitler and IG Farben closer together. Bosch and the chemists at IG Farben worked to solve the problem of rubber, because it was essential for warfare and there was no other source for a Germany without colonies. Cheap and abundant German coal was to be transformed via hydrogenation into lubricating oils and gasoline for use in cars, tanks and aeroplanes. Hitler increased research money for this important work. Synthetic nitrates, oil and rubber were the formula for German 'independence'. From coal, oil, air and power, thousands of synthetic materials and textiles could be made. IG Farben's many factories worked to churn out a parallel world of stuffs.

DYEING FOR A VOLK

In 1937 IG Farben was Nazified. Almost all the members of the managing board who were not already members of the NSDAP signed up. The Jewish directors were removed. The following year a lavish celebratory volume appeared. *Erzeugnisse unserer Arbeit* ('Products of Our Labour') showcased the IG Farben company. It is a most modern book, made of the latest IG Farben products. Its cover is celluloid, of AGFA Pelloro, and the book incorporates a variety of modes of colour printing, as well as black-and-white photographs. The first page shows a brightly coloured illustrated scene. In the foreground a large red flag with white circle and black swastika hangs in front of the modern IG Farben administrative building in Frankfurt. Wreaths, flags and a swastika above the main entrance adorn Poelzig's undecorated functionalist architecture. The opening section of *Erzeugnisse unserer Arbeit* is titled 'One of 125,000'. There is a drawing of a worker who stands in front of smoking chimneys. It is 1 May. Mayday has been reinvented, since 1933, as a celebration of well-disciplined labour.

All productive German people, our day of celebration is here: the first of May! April showers and belated snow flurries are a thing of memory. Seeded with flags, the town looks out in the warming rays of the Spring sun. The day of class struggle and hatred of people for one another is elsewhere in the world; here it is day of national labour, order and unity.¹⁰

This Nazi-friendly company history details in its opening pages a striking vision of how new chemical substances have infiltrated all aspects of everyday life. A worker who is one of the 125,000 articulates the vision. He tells of how he is sitting in his company house and looking at the other neighbouring houses. The words of the managing director of IG Farben echo in his

head. He begins to reflect on the concept of IG Farben, and his ties and bonds to the company. He realizes that his relationship to IG Farben is not just a professional one: it accompanies him, his family, his friends and all Germans on every step of their lives. He reflects on every object in his house – IG Farben or not IG Farben? The curtains are shining as brightly as when first bought, because of IG Farben's synthetic dyes. His wife in the garden is setting out the table for coffee. Her Vistra dress, her apron, the artificial silk table-cloth are all as bright as when presented to her. The light blue crockery, the butter dish, the child's beaker are all made of Pollopas plastic from IG Farben. Marching songs are broadcast on the radio. The radio casing is of artificial resin from IG Farben. Some photographs on the wall were taken with the cheap AGFA box camera, also from IG Farben. The colour in the frame stems from an IG Farben product. The paints on the walls of the room are IG Farben too. The worker speaks of an illness suffered by his son, and how he was treated in an IG Farben institution. The headache tablets in the cabinet are from IG Farben's Bayer. A moth flies by, and he uses IG Farben's Eulan spray to kill it. The red colour in the tips of his matches comes from IG Farben, as do the tip's chemicals. IG Farben made the cellophane wrapper of his tobacco. The ashtray is made of an IG Farben light metal. The bathroom is full of IG Farben products. Even the pink colour of the soap is an IG Farben dye. The mouthwash, the toothpaste, the toothbrush handle, the viscose sponge, the sun lotion, the medicines, the Indanthrene-dyed towels and bath robe and flannels. An aeroplane flies past. Its body and its motors are developed by IG Farben. The petrol is from IG Farben, and is of German coal. The worker is called out to the garden by his wife. She wants to serve him coffee. On his way to the garden he sees some balls of Huminal, an IG Farben fertilizer, which he tells us is part of the 'struggle for the independence of German agriculture'. In the hallway hang all the synthetic clothes, dyed, made waterproof, all thanks to IG Farben. And then there is mother's sapphire, made in an IG Farben factory, and the rubies in his watch that keep it ticking, so that it is always accurately IG Farben time.¹¹

How should all this be read? It may be an ostensibly positive hymn to the power of modern chemistry or a paranoid vision of the industrial world as a monopolized and totalitarian world of fakes and substitutes that holds everyone in its clutches from cradle to grave, from individual birth to mass death, and from which there is no escape? Paeans to the chemical industry, such as in this IG Farben book and countless others, do not mention stifling confinement and ignominious death but rather assert the improvement, lengthening and facilitating of life. This was a widespread story of science in the twentieth century, but it had a specific force in Germany because of the desperation to replicate lacking natural resources. The language of popular science in Germany at this time was more or less directly tied up with the political direction of the Reich. One chapter in *Erzeugnisse unserer Arbeit*, called 'Das Reich der Farben', the empire of colours, begins with a quotation

from Goethe's *Faust*: 'Am farbigen Abglanz haben wir das Leben', 'Life exists in colourful reflections'.¹² The anonymous IG author argues that a life without colour is unimaginable and colour is synonymous with the affirmation of life. Colour fizzes in the plant world and the animal world, both with their surplus of colour, and in the 'magic bridge' of the rainbow, the 'epitome of the colour fairy-tale of nature'. In the human world colour quickly attaches itself to the destiny of individuals and peoples. The text insinuates the racializing of bodies that is core in the Nazi world-view: 'Besung by poets and lovers across time, the colour of skin, of hair and eyes often took on fate-determining significance in the life of the individual just as in the life of whole peoples'.¹³

This was the Nazi aesthetic, where the specific attribute of an individual, the colour of skin or eyes, was converted into an example of a generality, a genus, a type, a genetic example. Nothing existed for itself but only for the classifiers. And colours and other *Ersatz*-products created in the laboratory enabled a new control of nature and the fate of peoples. Synthesis came to mean autarchy and the breaking free from foreigners. *Erzeugnisse unserer Arbeit* acknowledges the importance of coal in making possible all this parallel world of substances and products. Coal deposits, shiny black, have locked inside them a previous world of life, and all its colours. Coal is the primal material out of which imitations of nature, based on carbon, can be made. Coal is the beginning of everything. The development of indanthrene dyes is the great success story in the realm of colour. This eternal colouration, a permanent fast-coloured presence, seems almost to become a unifier of the Reich itself. A series of images compares the colour constancy of Indanthrene dyes and *unecht* dyes, non-genuine colours, which give up their hue after just a few washes. Nazi science is able fully to assimilate the artificial and the inauthentic, despite the emphasis in its ideology of human existence on 'the genuine', the *echt*. There is an overriding scientific and technical ideology that transfers utopia into a non-human realm, a realm where objects and political systems alike are eternal, unassailable and impervious.

Erzeugnisse unserer Arbeit was one of many celebratory histories of the science of synthesis published in the Third Reich. Others similarly wrote a nationalistic and, at times, racist history of chemical endeavour. In 1937 E. Barth von Wehrenalp's *Farbe aus Kohle* ('Colour from Coal') appeared in the Kosmos-Bändchen series.¹⁴ This little primer on coal-tar dyes tells the story of the 'Kampf um Farbe', the 'struggle for colour'. Von Wehrenalp mentions the synthesis of indigo at BASF.

In 1906 the colour merchants realized soberly that even the most important colour dye delivered to us by nature had become superfluous. Chemistry has triumphed over nature as the producer of dyes. Artificially manufactured colours rule the world.¹⁵

This was German colour made in German factories, in the only land where, according to Von Wehrenalp, merchants do not determine affairs.¹⁶ Germans, he notes, are lucky to have this abundance of synthetic colour. German women benefit in particular from this advance, for they are unlike the women of the US, who, lacking dyes, have to spend so much time washing their white clothes. Von Wehrenalp's language is combative, enmeshed in a deathly logic: 'What does any of this mean in relation to the fact that two chemists in a German laboratory managed to carry out the fatal blow against one of the most important natural dyes, against madder!' ¹⁷

Indeed 'it must have been for every chemist an uncommonly delightful task to pronounce war against this natural colour stuff'.¹⁸ Why was the fight against madder so important? Von Wehrenalp notes that it is because of its particular colour.

Red is for all peoples the colour of life, of love and of passion. Red is the colour of both of the elements of life: the blazing heat of the sun and fire. In earlier times red was the colour of wedding dresses, and is still today in China. Red is the colour of the greatest contradictions. In it is embodied the dignity of kings and the blood of revolutions. Red means war, fire, murder, but equally under the sign of the 'red' cross gentleness and brotherly love is practised, and in our calendars holidays and days of celebration are painted red.¹⁹

Another contradiction, of which Von Wehrenalp must have been aware, is that red was once the colour on the flag of Communist revolution and now was the colour on the flag of bloody reaction. Red was the colour of struggle in the sense that red's ideological meaning was subject to a contest. Von Wehrenalp notes gleefully that the chemical dyes rapidly destroyed the French madder industry, and that, until the Great War, the trousers of soldiers in the French army were dyed in German artificial madder. In Von Wehrenalp's rendition the drive for independence goes beyond the question of the nation. 'Germany attempts to free itself from dependence on foreign forces in all areas. The desire for independence aims not simply at the political and economic areas. Attempts are also underway to become *independent from nature*!' ²⁰

Such independence relies on concerted efforts between factories, and Carl Duisberg is cited as a heroic figure who introduced the trust form that he had witnessed in the USA. This eliminates internal competition and consolidates the concern as a strong national bloc. The book concludes with a graphic illustrating the gigantic German export of colours in 1935, the world market conquered once again, after the setbacks of the First World War.

Walter Greiling's *Chemie erobert die Welt* ('Chemistry Conquers the World') appeared in 1938, and was reprinted in 1943 and again after the Second World War. The book tells a history of science through nationalistic phrases. Writing of August von Hofmann, who was working in an English

laboratory, Greiling notes that 'the German in him awoke. He decided to work systematically'.²¹ This entailed a return to Germany. The busy hands that set to work on coal-tar dyes were lacking in England: 'Here the young people were far too blasé. England was bloated and satisfied. It could not enthuse itself for the new tasks.'²² Progress is conceived here in terms of technical fetishism. One indication of this is on the first page, in the analysis of Leblanc's extraction of soda from rock salt, described as a discovery that changed the world more than the political shifts ushered in by the French Revolution, which was simply a *lärmende Episode*, a boisterous episode.²³ Greiling's vision of modern chemistry is interwoven with the political and economic forms. The free market, he notes, ends in a technical epoch. Strengthened nations participate in an exchange economy, trading as blocks.²⁴ This is the context for a successful chemistry of substitution. Greiling eulogizes the parallel artificial world. All natural materials are the products of an ennobling, whereby impurities are removed from substances. In ovens and high-pressure cylinders chemistry repeats what nature did in the core of the earth. This imitation of the chemical processes in plants and animals is superior, because it has been chosen consciously. Greiling's account reads like special pleading for an epoch of ersatz.²⁵ Previously luxurious items, such as gemstones, silks, ivory, mother-of-pearl and the finest colours, can now be synthesized and are indistinguishable from their natural counterparts. They are then, in their faked versions, accessible to all.²⁶ Technology has created a new type of human, a technical human.²⁷ This technical type is enmeshed in the business of the world, and, in some sense, is isolated from nature and unable to think about the wider meaning of life. This gives a new role to the chemist, who is analytical and has an overview. The chemist understands nature because the chemist can reproduce it. The chemist is closest to the 'secret of life and more tightly bound to nature'.²⁸ When suddenly a material appears out of invisibility, in an instant, the miracle and secret of creation are revealed. Greiling outlines moments: when suddenly, in a glass retort, a mixture flares up colourfully; or when, in a clear liquid, a crystal grows in front of your eyes; or when invisible gases transform into salts. At these moments, we are gripped by the same shudder that grips us in birth, when the threshold from death to life is crossed. The epitome of creation is bringing something forth from non-existence. A new type of human who fears neither death nor devil, a 'Nordic' type, is able to discern the clear laws of nature and to turn its secrets into accessible teachings. The chemist is super-scientific, and yet, what the chemist can do appears to be magical. This rhetoric of science is scientific and magical at the same time. The 'secret of the priests' becomes the *Erobererrüstzeug*, conquerors' armoury, to be used by those who have most need, that is, *Ein Volk ohne Raum*, a people without space. Each chemical breakthrough is a conquering of that which has been previously concealed and whoever leads in this battle for revelation will be the 'greatest conqueror of the future'.²⁹

A novelized account of German chemistry's development, *Anilin*, was a bestseller. It was written in 1936 by the Nazi supporter Karl Aloys Schenzinger. Schenzinger was a doctor who began writing novels in the 1920s, the most famous of which was *Hitler Junge Quex*, which was made into a propaganda film in 1933. In *Hitler Junge Quex*, the young Quex first encounters the Nazi movement in the ancient German forest. It is night and he sees fires glowing in the distance. It is a ritual ceremony at a Hitler Youth camp, and a hundred or a thousand identically dressed youths are among red flags with jagged symbols on the cloth. The boy cannot resist the compulsion to join them. This was German soil, the German forest, and these were German youths. This German forest was also the place where coal would be found, from which would be made coal tar and aniline. *Anilin* was continuously in print from 1936 to 1953, selling more than 1,750,000 copies in book-club editions.³⁰ Its chapters marked the stages of chemical development, all of which, apart from indigo itself, emanated from coal: indigo, illuminating gas, coal-tar, aniline, benzene, synthetic indigo, and the final chapter presents the quinine-substitute Atebrin. In *Anilin*, Schenzinger uses Friedlieb Ferdinand Runge to espouse a Nazi philosophy of science couched in Romantic terms. Nature is presented as a living whole, in union with souls that are pure. Runge is presented as a tragic figure, because he was not taken seriously enough in his day, and so the well-publicized discovery of mauveine by Perkin in England delayed German supremacy in chemistry and robbed Germany of the glory.³¹

The celebration of F. F. Runge as a German nationalist also appeared in a biography of Runge written by Bertold Anft in 1937:³²

Runge was an upstanding German man. He hated all that was foreign; as we know already from his time in Breslau, in his very first paper 'Materials on Phytology' [1820], he dedicates a whole chapter to the 'name-contrivance' (*Namenmacherey*), which had found its way into chemical language and he attempts to replace it with simple German terms.³³

In 1857, Anft notes, Runge returned to this theme in the self-published 'The Poison of the German Language, Driven Out by Runge'. Anft equates Runge's drive to popularization in an enlightened bourgeois epoch with a nationalist zeal:

His literary works are saturated by the thought 'Write for the general reader and, in that way, be effective for general use [*Gemeinnützlichkeit*]'. Of course this striving was understood by only a few in his day, and almost three quarters of a century had to pass before this genuine German effort became a common heritage of the German Volk.³⁴

And, notes Anft, just as the Prussian state had bought the chemical factory where Runge researched, in order to promote production and thereby achieve independence from abroad,³⁵ so too Runge's final efforts were put into the synthesis of guano, for he wanted German fake bird droppings, so that Germany might gain independence from other countries. Runge's fascination with the immanent properties of substances was travestied as the national chauvinism promulgated in the Third Reich. This rhetoric of scientific achievement predicated on national yearning and *Volksthümlichkeit* ran counter to Walter Benjamin's observation in a book called *Deutsche Menschen*, of 1936. *Deutsche Menschen* was a selection of letters with introductions written by Benjamin, under the pseudonym Detlef Holz. Benjamin hoped to give a sense of a progressive bourgeois literary and scientific tradition in Germany, a tradition that had been eclipsed by fascism. Benjamin notes that Liebig, in 1870, in an address to the Bavarian Academy of Sciences, spoke out against national chauvinism. Science belonged to humanity as a whole, and the most progressive Germans fled Germany in order to pursue research in more democratic circumstances.³⁶ Benjamin repeated this claim in an essay of 1939 on Germans of 1789 and, in 1940, noted that Liebig saw Paris as the metropolis of world citizenship.³⁷

In contrast, popular science books asserted the triumph of German research, the rise of the 'technical type' and the powers of the magician-scientist. They had good reason. German inventions were widely celebrated. In 1937 IG Farben received the Grand Prix at the World Exhibition in Paris. Picked out for special mention were Agfacolor films, the synthetic rubber Buna, the anti-moth substance Eulan, light metal-alloy hydronalium, the indanthrene dyes, the medicine Prontosil and the spun rayon Vistra. Kalle & Co. received a silver medal for 'Cellophane velvet'. Celebrated was a synthetic world of stuffs whose acronymic names signalled progress and a bright future. Buried sometimes inside their incantatory syllables could be found compact capsules of ideology and policy. Vistra was one of these. It was invented in 1920 and its name, 'encompassing past and future', was a composite of Vis and Tra.³⁸ Vis stemmed from the telegram address of the firm that invented it – Köln-Rottweil AG – Sivispacem, from the Latin phrase 'If you want peace then prepare for war' (*si vis pacem para bellum*). Tra was from Astra, the telegram address of a partner firm Alfred Nobel and Co. This stemmed from the phrase 'Per aspera ad astra', meaning through adversity to the stars, but glossed in *Erzeugnisse unserer Arbeit* as akin to the election slogan 'Durch Nacht zum Licht', 'Through night to light'.³⁹ Vistra had more to tell. It represented a release from foreign dependence, because Germany no longer needed to import wool and cotton from abroad, now it had a source of cellulose fibre. The price sunk and other artificial silks were made: Cuprama, Acetafaser and Lanusa. Hans Dominik wrote a book on Vistra, which he called 'the white gold', in 1936.⁴⁰ The largest rayon works in the world was built by IG Farben at Wolfen, its fibres spun from the German beech. Through

The Nazis examine
 Vistra at the 1937
 exhibition 'Industrious
 People', from IG Farben's
*Erzeugnisse unserer
 Arbeit* (1938).

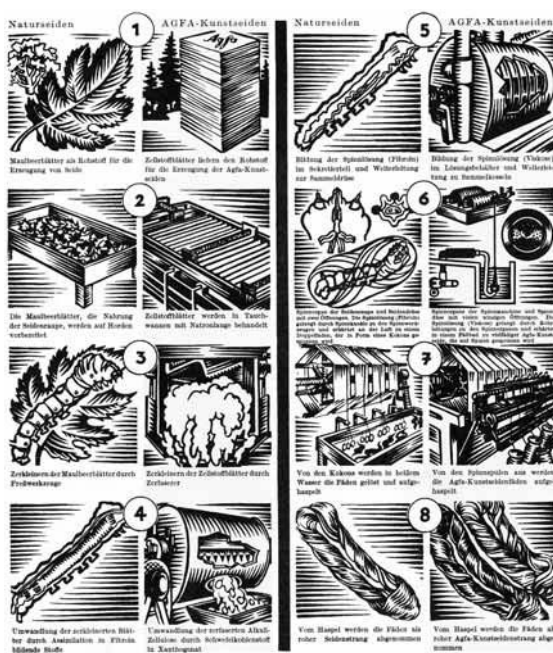


the inauthentic and synthetic Germany is restored to itself. German coal and German wood, these ur-substances, can remake the nation.

Cellophane was another of cellulose's wonders. *Erzeugnisse unserer Arbeit* reserves special praise for this material:

Capable of transformation, it appears in our house, used for this, used for that, we meet it on our travels at home and abroad. It is a material that excites the imagination like hardly any other, sometimes useful and modest, sometimes noble and untouchable.⁴¹

That is cellophane, 'this something that is see-through like glass but is not glass, something that is wafer-thin and yet tough'.⁴² Cellophane seems to possess a moral quality. It allows the preview of goods, backing thereby a new consumer honesty. It wraps and packs, protects, preserves and exposes. It also makes gleaming metallic strips, called Cellometall, used in belts, and hair ornaments for beautiful German womenfolk. It makes copyable documents and home cinema film. It even replaces the German sausage skin.⁴³ More hygienic than the stuff of nature, cellophane is worthy of entering German bodies.



The production of natural silk and AGFA's artificial silk, from *Erzeugnisse unserer Arbeit*.

LAND OF SUBSTITUTES

Once the Second World War had begun, the adeptness of German science at substituting for nature became, in the eyes of the Allies, proof of the regime's suspect ingeniousness and illegitimacy. In the early 1940s *Germany: Land of Substitutes* by Olaf Nissen was published in Britain. It was propaganda, written as part of the war effort, and was a compendium of efficient, absurd and sinister scientific discoveries in Nazi Germany.⁴⁴ Nissen reports on the things that Nazi scientists and ordinary citizens are cooking up industrially and in their homes: waterproofs made of fish scales for Nazi submarine crews; sound-excluding bricks made of waste and offal; old linen collars boiled to convert them into the rare foodstuff of sugar to sweeten jam; synthetic cocaine to replace the Javanese supplies made inaccessible by war; sawdust bread; soap made of potatoes or tomato refuse; cement made of beets; army furs for the Russian campaign made warmer by benzene spraying; collapsible paper lifeboats; the derivation of leather from odd sources, such as the carcass of the sportive porpoise; and other practices to eke out dwindling resources. The book jacket revealed the adroitness of German science and the dangers associated with efforts to investigate it.

German resourcefulness in invention and in producing ersatz – substitutes for materials from sugar to paper, from rubber to coffee, which are in short supply owing to the War – is fully dealt with by the

Author, whose life became in danger from the Gestapo when he proceeded to make enquiries regarding scientific details of ersatz.⁴⁵

Nazi Germany is a 'land of substitutes', fakes and inventions born of necessity. The propagandistic aim of the book sways between disapproval of curious and alien Nazi practices and admiration for their inventive spirit, a spirit encouraged by 'ideas boxes' in every army platoon, to which soldiers contribute, apparently in the hope of promotion. The book aims to demonstrate the power of 'average Nazi inventiveness' multiplied by a nation.⁴⁶ Nissen lists more than 250 devilishly clever practices and inventions that aid the war effort, remedy shortages, counterfeit artefacts and anticipate the shape of a post-war Nazi future. The British people need to emulate this creativity, although Nissen does not wish to suggest 'that all the ideas outlined are sufficiently practical when judged by Democratic standards'. The introduction reveals the extent of this art of faking:

If you dine at a restaurant, your beefsteak may have been manufactured from the cells of coal, thanks to German scientists. Your suit or dress is almost sure to be ersatz and not able to boast even a mild flirtation with genuine wool or cotton. More likely is it to be derived from animal or vegetable offal once considered worthless. There is a substitute for almost everything, and if one is wise they shop on the assumptions 'no questions asked – none answered'.⁴⁷

Nazi Germany is a land of deception, and the population tacitly accepts the dissimulation. Its people too seem to have become ersatz-humans, unquestioning and nourished on 'coal, and waste substances such as iron rust, button chips, straw, brewery and distillery refuse', which are being transformed into human food:

In coal, one German scientist sees vast quantities of valuable food going up the household chimney in the form of smoke, though it may well be the occupants of these houses are on the verge of starvation.

By means of secret formulae and processes, coal in this expert's hand is made to produce a protenoid containing all the necessary elements of a beefsteak, insomuch that it supplies both muscle and tissue to the body, as well as feeding the brain.⁴⁸

Artificial meat from coal or from brewer's waste, iron rust producing formaldehyde from which sugars can be extracted, flour made of button waste, straw as food, these foodstuffs sometimes exceed the nutritional value of normal food. Nissen also mentions that 'Germans suffering from Allied air-raids are being served with gunpowder with which to steel their nerves'.⁴⁹ The gunpowder is mixed in with gravy or taken as 'stamina' tablets. Ingestion is

supposed to work homoeopathically to strengthen the body against that which attacks it. A dissolving from the bonds of known nature is underway. Nissen reports on the idea promoted by 'Nazi experts' that certain foodstuffs of the future will be drawn from the atmosphere instead of from the land, using ultra-violet rays, so that ploughing, sowing and reaping may be dispensed with.⁵⁰ These same UV rays can extend the life of artificial silk threefold.⁵¹ This substitute world is better than the old world where nature has become malevolent, for example, the odour of flowers may be distracting to airmen.⁵² Or nature needs to be improved upon. German bees, for example, are 'spurred by radio to increase honey yield'.⁵³ German beekeepers, compelled to increase the bees' output, are encouraged to use the radio to pacify swarms.⁵⁴ This is a land where everything is regulated. Bees must wipe their feet on synthetic rubber doormats before entering the hive, to avoid importing infection.⁵⁵ To save artificial fuel, Nazi experts promulgate a code of less absorbent, lighter colours for housewives' decoration of house walls.⁵⁶ But German science has devised even greater wonders. It is truly magical, for it is able to access the past. Nissen reports on the new uses of the camera in solving murder:

Due to the 'mysterious' killings of German soldiers in occupied Europe, a novel plan is being tried. It consists of photographing the dead person's eyes. If successful, it may revolutionize police methods at present in vogue.

According to Nazi experts, the eye has a striking analogy with the photographic camera, and it has been supposed that a picture might be found on the retina of a dead soldier's eyes, which in the case of murder might lead to the identification of the murderer.

German experts are divided on this point, however. Those who scoff at the idea argue that because time is required for the picture to make a lasting impression on the retina, the difficulty of photographing it is great. In support of this it is said that a man on the scaffold, whose eyes had been kept in darkness, was instructed to fix them on a certain object before the drop fell, and a microscopical examination of his eyes showed an inverted image of the object in each, but of vague appearance.

Supporters of the new 'clue' believe that something can be done to photograph such an image with a microscope, and so put crime beyond the reach of most ordinary people.⁵⁷

Nazi science casts its shabby conjuration, and sets its mind not just to the ersatz of useful materials or the control of nature and people. It works its magic on time too, seeing into the past. But it can feign a past as well: it fakes German war souvenirs, by feeding coins, medals and small keepsakes to turkeys where they rust rapidly and the gastric juices produce a green patina. The stones in the birds' gizzards generate instant wear and tear,

producing a counterfeit object in less than a month.⁵⁸ Or it prolongs the life span of banknotes by waterproofing them or developing a plan for post-war currency made of tobacco waste that has been chemically manipulated to be more durable, germ-proof and washable.⁵⁹ This is necessary, for German money must be unpolluted.⁶⁰ But, warns Nissen, paper money of any kind may not feature in the post-war Nazi new world order. Currency for trade is in short supply and gemstones, especially faked ones, make a good substitute. The Nazi scientists have faked sapphires from aluminium powder and oxide of cobalt. Aluminium is also the base of artificial rubies, emeralds, amethysts, topazes, which, he reveals, 'the Germans intend to exploit after the war, as a trading medium in place of gold'.⁶¹ Blemishes in diamonds are removed by bleaching in intense heat, while pearls are renovated in old milk and cheese offals.⁶² Sham stones and lacklustre precious gems can have their lustre simulated through the weed Spanish Bayonet.

High prices are exchanged daily for these camouflaged stones, it is said, and some German soldiers have found themselves wealthy overnight. Whether the 'cure' is really lasting, is not mentioned. Probably it is only of a temporary nature, and the buyers stand to lose heavily.⁶³

In any case, 'Nazis experts are making handsome profits testing the precious gems for those in doubt', having invented a 'three-way test' for genuine rubies.⁶⁴ Counterfeiters and adjudicators, the Nazis have the material world under their grip. And yet for all this one-way mastery of nature, Nissen writes about a German science that appears to be under the spell of Romantic ideas involving the exchange of properties between humans and objects, people and matter. It is gemstones that show this most dazzlingly:

A new trade has sprung up in Germany, namely overhauling 'blitzed' diamonds that show signs of deterioration owing to air-raids making them 'dizzy'.

When a diamond becomes 'dizzy', say the Nazi experts, the off-colour condition may be due to a fright on the part of the owner or wearer of the gem, and this reflects in the colour of the stone, usually causing it to lose its brilliancy and take on the cloudiness characteristic of cheap and comparatively worthless gems.

To remedy the fault, Nazi experts first rub the diamond with genuine eau-de-Cologne and, while still damp, placing it in very fine sawdust where it is whirled in a rubber-lined container or shaker, driven by mechanical means, until the proper degree of brilliance and lustre is restored. The process ends with a final polishing with a specially prepared chamois leather. The treatment costs from one hundred to one thousand Reichmarks, and takes the best part of three months to complete, according to the deterioration in the gem that has taken place.⁶⁵

Another example, under the heading: 'Aerial Warfare Turns Diamonds "Pale"', seems to suggest that our ancestor-gemstones might even substitute for our unconscious. Gems might be the matter where trauma marks itself, and so is shut off to the remembering mind. Nissen notes that since the intense Allied air raids on Germany, there are more spoilt diamonds: 'Mostly the gems turn "pale" due to the fright of the wearer'.⁶⁶ Nissen does not explain how this fright is transferred. He does, however, mention the 'fright' that arises from a blow.⁶⁷ Whether received directly or by transference, this trauma can burst into being, much as might also, years after its occurrence, a bad event held in memory.

Diamonds, especially in war-infested areas, frequently receive blows which, on examination, do not appear to be harmful. But once a gem receives a 'fright', it is pointed out, the defect may present itself at an unsuspected moment. When this happens the owner wonders at the change, never suspecting the blow now long since forgotten.⁶⁸

Here is an image of forgetting or repressing an original hurt. Here is a chance for remembering the moment when everything went awry, when the violence began. But it is restricted to the inanimate object, not able to surface into human consciousness. This is all the better for the masters of the master race.

MATTER AND MASTERY

The manual *Erzeugnisse unserer Arbeit* of 1938 opens with a worker's reflection on the infiltration of IG Farben products into his company house. The synthetic dyes are all as gleaming as when first acquired: his wife's dress, her apron, the artificial silk table-cloth, the light blue crockery, the butter dish, the child's beaker – all chemical marvels, all denying the passage of time, the traces of natural decay or history's ravages in usage. These are dreams of industrial modernity. Modernity, forged by industry, is smooth and ever-new. In textiles, modernity is manifested in the efforts to invent synthetic dyes that do not fade when exposed to sunlight, that do not bleed when rinsed or boiled in water, that hold their colours for year after year. Textiles could be made synthetically, crease-proof, tear-proof, denying the passage of time, the wear and tear of movement.⁶⁹ In a pursuit of mastery, a Robot Cloth Flaw Detector was said to have been invented. The machine is dressed as a soldier – and then worked by mechanical means so as to ascertain the actual wearing qualities of the cloth. The robot has a skeleton of steel, and the flesh filling is supplied by means of sand or sawdust, so as to conform to practically any desired weight. This robot sits and stands thousands of times, until the cloth of the trousers wears through. It bends its arms mechanically, investigating how long the soldier might raise his arm and fire his weapon

before his seams burst or his sleeve tears at the elbows. A delicate weighing scale shows the weight of the uniform before and after tests, and the difference in the actual weight shows just how much of the material is lost in the process of actual wear.⁷⁰ This flaw-detecting machine conjures up industrial modernity's dream of efficiency, economy, prescribed movements, an administered society, where even the precise moment of failure ought to be predictable. Its corollary is administrators' attempts to subdue material, be that fabric or human, in order to aim at an ideal realm of ideal forms, technically perfected. These ideal forms, imaged here as the perfectly performing robot soldier, are killing machines, fulfilling Ernst Jünger's fantasy of the soldier-worker in *Der Arbeiter: Herrschaft und Gestalt* of 1932, as automaton, ahuman and anatural in a totally mobilized society. The new machinic person is a worker-soldier technocrat, who is a 'type', and is motivated by 'the will to utilize technology'. He subordinates his self to the 'total state', and the reward is immortality. Despite Jünger's fantasies, the soldier-workers' bloodiness, fleshliness and unarmoured singularity reasserts itself on the battlefield. It is in this context that a comment by Adorno and Horkheimer in *Dialectic of Enlightenment* resonates: 'In man's denigration of his own body, nature takes its revenge for the fact that man has reduced nature to an object for domination, a raw material.'⁷¹

Until eventually the whole elaborate machinery of modern industrial society is nature bent on ripping itself to pieces.⁷² The enlightened knowledge that reinforced the rise of the bourgeoisie and industrial capitalism has been used to abuse humanity, and domination of nature has become also the domination of nature within humanity. The Soviet Union, at the same time, was engaged in a similar arrest of history, in a highly technical battle against nature. Mummified in Moscow, Lenin lay in his mausoleum on Red Square, frozen on Stalin's orders, and later biochemically preserved in baths of potassium acetate, glycerine and other chemicals, his skin's dark patches bleached by hydrogen peroxide, his lips and eyelids stitched closed, a pink light contributing a glow of vitality. All was slowly rotting. Lenin was kept on show as proof that the Revolution itself was still alive. When Lenin's widow beheld his body in 1938 for the final time before her death, it is said that she exclaimed: 'He is just the same, but look how I have aged.' An external shell is preserved. The body does not rot, but it is now no longer natural form on its own terms. The dyes do not fade. The cloth does not tear. This shadow world might last forever.

Nature's self-destruction was expressed most dramatically in fascism. Fascism abused nature, not least in ideologically promoting its realized German idyll as grounded on nature's unmediated goods of blood and soil. Nazi ideology promoted nature as refuge and as alibi: German bodies with German blood, German landscape, German soil were the legitimating figures of the Reich. Nature was its justification, but, in fact, it was busy destroying nature. This happened not just through the synthesis of natural

forms, but through the efforts to control it, to improve upon it, in various ways, including promoting the perfect Aryan muscular bodies of the superman and to purge from it those bodies that had been denatured, the Jews, the disabled, the weak. Such pains to tidy up and emend nature, the eternal *Volk* bound to its everlasting soil, relied on the efficient and brutish procedures of nature's assumed opposite, the vast technical machinery that would carry out not only the work of substitution but also the operations, the elimination, the experiments.

SOAP AND GAS AND HUMAN MATTER

The IG Farben conglomerate wanted to devour more concerns, and state violence permitted this. In 1939 the luminous Bayer Cross was switched off, so that light became night again, and war began. The chemical factories in Austria were gobbled up immediately upon annexation. War was the means through which the chemical industry could grow further. Foreign factories were seized and with that their markets. IG Farben's profits went up from 363,000,000 to 822,000,000 Reichsmarks between 1939 and 1943.⁷³ Other large concerns, such as Krupp's and AEG, evidenced similar successes. IG Farben's gratitude was expressed in donations. The company gave 500,000 Reichsmarks to Hitler for use in the Sudetenland just after the invasion. The day following the invasion a telegram of congratulations from Hermann Schmitz, the head of the concern, read:

Profoundly impressed by the return of the Sudetenland to the Reich which you, my Führer, have achieved, the IG Farben-industrie AG puts a sum of half a million Reichsmarks at your disposal for use in the Sudetenland territory.⁷⁴

The chemical industry's appreciation was also expressed in the conversion of its dyestuff industry to the production of war materials. This was achieved through the institution of the Four-year plan. Carl Krauch, the head of the nitrogen and petrol division of IG Farben, was placed in charge of the Research and Development Department for Raw Materials and Foreign Currency on Göring's staff. A member of the Nazi party from 1937, he took over the Research and Development Department in the Office of German Raw Materials and Synthetics under the Four-year plan. He was also Plenipotentiary General for Special Questions of Chemical Production. On 10 February 1943 Von Schnitzler noted that

It was only in war that German chemistry was able to deliver the great test of its worth. It is no exaggeration to say that a modern war would be unimaginable without the results that the German chemical industry achieved under the four-year plan.⁷⁵

After the war in 1947 at Nuremberg, Heinrich Bütefisch, director of IG Farben, observed: 'Without IG Farben, especially without IG production in the fields of synthetic rubber, synthetic fuel and magnesium, it would have been impossible for Germany to wage a war.'⁷⁶

It was not just war that IG Farben and other industries in the Third Reich's 'united front of trusts and technology' helped to bring into being.⁷⁷ The firms also participated in the construction of concentration camps. The cooperation of high-grade construction engineers was essential. In turn, these camps became places of scientific research for the drug and chemical conglomerate. At Dachau and Auschwitz, laboratories were built for research into medicine and biology. German pharmaceutical companies sent new preparations to the camp for testing on inmates. Malaria germ testing was one such area of research. Sterilization by x-rays and by the use of chemicals was carried out. Artificial impregnation was another area of research. Dr Josef Mengele, the assistant at the Institute of Hereditary Biology and Race Research, founded in 1934 in Frankfurt by Prof. Otmar Freiherr von Verschuer, was able to further his research at Auschwitz. His area of special interest was the biology of twins. Transplantation of cancer tissue into the uterus was another operation carried out here. Other experiments included the subcutaneous injections of petroleum and the application of electric currents to the brain. Unnecessary amputations were performed, and mutilated patients were then sent to the gas chamber. At Dachau prisoners were frozen by immersing them in ice-cold water, in order to test methods of revival. Such tests were started on Göring's orders in May 1942.⁷⁸

The Romantic affinity between humans and the world of anorganic matter marked a utopian potential for expanded and cosmic experience, but the danger, under certain economic and political conditions, was that the balance could tip towards a flooding of the senses by substitutes, and the turning of humans, some humans, into a raw material for science and for industrial production. Plastics and fakes invaded the world and generated a parallel universe. Here, in the Third Reich, it seemed as if the autonomy of human activity and thought might be squashed in the process. This was a world where human skin could make a lampshade and lives deemed worthless were sacrificed in order to recoup their mineral deposits, such as gold teeth. In the camps the corpses were a resource for raw materials. Their hair was stripped. It was rumoured that Jews had jewels, gold and platinum hidden inside hollow teeth. Gold was mined from the mouths of Jews. The affinity between humans and minerals, the organic and the anorganic, became a death-clutch. After this plundering corpses were burned rapidly and economically in the crematoria, for fresh corpses burn particularly well and require only 25–50 kilograms of coke. All this work was carried out by Jewish prisoners who would never leave the camp and foresaw thereby only their own destiny.⁷⁹ Before this despoiling could occur, a means of death was needed and there was a product that the worker who was one of 125,000 did

not mention. Perhaps it was too early for him to know its new uses, but the chemical already existed. Zyklon B was made by the Deutsche Gesellschaft für Schädlingsbekämpfung, known as Degesch.⁸⁰ IG Farben owned 42.5 per cent of Degesch, while Degussa (of which IG Farben owned a third of shares), also held 42.5 per cent. Zyklon B was the pest control agent used by the Wehrmacht when it needed to delouse effects or destroy insects and rodents in premises. Zyklon B was Prussic acid mixed with an irritant. A carrier such as wood fibre discs, a reddish-brown granular mass or blue porous silica absorbed the mixture. The warning stuff or irritant that signalled its presence, thereby allowing a person to take protective measures against its high toxicity, was removed because of shortages as the war raged. Degesch's gas was probably first tested in 1941 in the gas chambers of Birkenau on 800 or so Russian prisoners of war. It was the fulfilment apparently of an arch-German mission. As Carl Krauch observed in 1938, 'The chemical weapon is also from the standpoint of its application a typically German weapon, because it corresponds to the particular natural-scientific-technical aptitude of the Germans.'⁸¹

Degesch's gas business was lucrative. The company made an annual profit of 200 per cent from the production and sale of Zyklon B.⁸² The managing director of Degesch claimed not to have learnt of the abnormal uses of Zyklon B until the summer or autumn of 1944, although he suspected that it may have been occasionally used in the elimination of the weak.⁸³

IG Farben was directly involved in the concentration camp at Auschwitz. In order to attack the USSR, the German state needed to increase production of Buna substitute rubber for its invading army. A new factory was necessary to increase production. It was decided to build a factory near Auschwitz. The IG Farben directors agreed to carry all the costs, since they were eager for the expanded markets that they hoped would fall to them in Asia and the USSR.⁸⁴ Inmates from the camp, alongside civilians and prisoners of war, would build the plant. IG Farben agreed to pay the SS on average 5 marks 30 pfennigs per day for an inmate who was a skilled worker. The calculation assumed that the labour power delivered by the inmates would be around three-quarters of that delivered by a normal nourished German worker.⁸⁵ The SS pocketed the money.⁸⁶ The process of building the factory caused problems. The mix of civilian and inmate labour posed difficulties when disciplinary measures were meted out or when cartloads of bodies who had died on the job were wheeled past on their way back to the camp for the roll call. And the plant was some distance from the camp, which led to security problems, and shortened the working day to the hours of daylight. In the summer of 1942 IG Farben decided to build a factory that was itself a concentration camp, called Auschwitz IV, at Monowitz. Now it would no longer be necessary to undertake a long walk from Auschwitz. The diminishing energy of the inmate workforce would be saved and supervision made easier. Private capitalism and the state worked in harmony. IG Farben was responsible

for accommodation in barracks and the care of inmates. The ss supplied the bunks. The ss also supplied the guards. IG Farben contributed factory police. The ss took on the surveillance, discipline and supplies of inmates. Auschwitz IV had all the features of other concentration camps: watchtowers, barbed wire, sirens, armed guards. There was a gallows on which were usually hanging the bodies of two or three workers. The motto *Arbeit macht Frei* was emblazoned above the gates.⁸⁷ Thirty-five thousand prisoners were deployed in the Buna plant of IG Farben in Auschwitz-Monowitz. They were selected from the extermination transports and used as labourers. Those deemed unfit for work were gassed at Birkenau. The remaining life of a prison worker at Buna was between three and four months. Those who worked in the coal mines nearby lasted one month. If IG Farben asked for punishments for miscreants, the ss were happy to administer them, whether it was the withdrawal of their meagre food, beatings or whippings, public hanging or 'selection' for the gas chamber.⁸⁸ The day began at 3 o'clock in the morning. ss guards oversaw all work. Too great a movement outside the small 10-by-10-metre work-post resulted in immediate execution for attempting to escape. Spiteful ss guards would sometimes order a worker to fetch something and then shoot him for exiting the square.⁸⁹ Monowitz consumed more electricity than all Berlin, but despite the investment of 900,000,000 Reichsmarks, all the efforts produced no Buna and little oil. When the inmate workers were expended, dying on the job or sent to die in Birkenau once incapable of further labours, their bodies became so much raw material bodies to be recycled. Before being sent to the gas chambers, inmates were shaved, and their hair was sorted, packed into bags and shipped to Germany to make felt, blankets and mattresses. In the early days bones were ground up and chucked into the river. In 1943 managers at the camp realized that they could sell the bones to produce fertilizers. Ashes from the ovens were carried directly from the crematoria to farms in the vicinity for fertilizing, although sometimes a handful of collective ash was sent back to relatives after receipt of payment.⁹⁰ And there was the unproven rumour that human fat was turned into soap. The New York *Herald Tribune* reported it as fact on 9 December 1945 under the headline 'Nazis used human bones in soap'.⁹¹ It reported Colonel Edward J. York's witnessing of a German concentration camp in the centre of Danzig (Gdansk), where the Nazis made soap out of human bodies. Alongside the fat cookers were recipes in German explaining the time needed to cook the various parts of human flesh and how to extract fats for soap-making. Some vats, he noted, still contained torsos and arms and legs. Some thought that at Auschwitz soap was produced from the corpses of Jews, and many Poles refused to use the soap cakes distributed by the occupying forces.

The Jews might be good enough to make soap or other raw materials, but they were not deemed good enough to constitute a race or a *Volk*. For the Nazis a *Volk* consisted of several hierarchized race components. The noblest

strain was Nordic, and the higher the proportion of Nordic blood, the higher the *Volk* in the world schema. The Jews were not a *Volk*. As racial science had it, they were 'a counter race' or a 'sham *Volk*'. They were a mixture of inferior races, not amounting to one, and so detached from the soil in their internationalism, they could not constitute a *Volk*, bound to the land and ethnically homogenous. They came to represent all that was negatively disposed, inauthentic, dissimulating and suspect. The Nazis, and with them the German *Volk*, represented, in contrast, all that was authentic. In the world of objects, *ersatz* was good enough, because Nazi scientists had remade the world technically, had mastered nature and improved upon it. In the human world, where nature was ripping itself apart, only that deemed authentic had leave to remain.

ALL THAT GLITTERS

In 1945 Adorno wrote a short essay called 'Goldprobe', 'Gold Assay', for his collection of 'reflections from damaged life', *Minima Moralia*.⁹² The title refers to the process of subjecting gold to chemical analysis, in order to determine the amount of impurity in the metal. In parallel fashion, Adorno's essay subjects the concept of authenticity itself to analysis, in order to find out how pure it is, or rather, how much of its content is, in fact, inauthentic. This excavation is a first part of Adorno's larger examination and indictment of pre-war and post-war fascist tendencies in philosophy. Authenticity and genuineness were philosophically current notions – later Adorno devoted the book *Jargon of Authenticity* (1964) to their ideological unmasking and demolition. Heidegger was a particular object of attack, for he had spawned so much of the discourse. For Adorno, the concepts of authenticity and genuineness were long vehicles of bigoted ideology. In 'Gold Assay' Adorno swipes at Heidegger and the existentialists:

To the converted and unconverted philosophers of Fascism, finally, values like authenticity, heroic endurance of the 'being-in-the-world' of individual existence, frontier situations, become a means of usurping religious-authoritarian pathos without the least religious content. They lead to the denunciation of anything that is not of sufficient sterling worth, sound to the core, that is, the Jews: did not Richard Wagner already play off the genuine German metal against foreign dross and thus misuse criticism of the culture market as an apology for barbarism?⁹³

Adorno notes Wagner's hankering to protect musical German-ness and his fear of its eradication by sub-standard foreign-musical imports and home-grown or imported Judaic music, made by the Jews who rule the world through money, and have no authentic relationship to musical form.

Adorno's imagery evokes Wagner's *Ring des Nibelungen* and its first section, *Das Rheingold*, where the words can be heard, 'Rheingold, Rheingold, purest gold'. Rheingold, 'reines Gold', is pure gold, and it is also German gold. In *Das Rheingold* gold is pure because it is natural, light and beautiful, but is stolen by the ugly dwarf and set to purposes of mastery by one who is prepared to renounce love. Money is metal in a bad form and it drives out good metal, which takes the form of gold. Gold and genuineness intertwine and both feed into parables of domination. Gold's debasement into money is an offence against nature by nature's own miscarriages.

After a war that is fought and lost by those who claimed to defend purity (of the race and the culture), the very concept of authenticity appears outmoded, and the 'seams and patches' that were in it from the beginning came to light: 'Untruth is located in the substratum of genuineness itself.' This substratum is the individual, the bourgeois idea of 'an ultimate and absolute substantiality of the self', exempted from social influence. Individualism asserts the 'fictitious claim' that what is biological must precede the social whole, 'from which it is only isolated by force'. It denies the entwining of the self in society. Instead there is an insistence on the authenticity of the self, or the biological identity that has retreated inwards. Insistence on the genuine might have once represented a critical insurrection against corrupt rule, but, once bourgeois rule is entrenched, it increasingly takes on dogmatic features. Adorno's essay, his analysis of the impurity of the concept, reveals the base of the matter: genuineness is, in fact, a by-product of the bourgeois capitalist system of exchange. The monad free of social insight is, in fact, 'the result of a social division of the social process'.⁹⁴ Social oppression imposes the illusion of separation. These features were in its concept from the beginning, but only gradually reveal themselves, in Kierkegaard, Ibsen and Nietzsche, until that point when genuineness becomes an axiom of domination ripe for Nazi usage. Metal is the metaphor through which racial superiority is imagined. The more genuine the metal, the more pure it is, the richer the stock, the more justified the tribe. Genuineness, notes Adorno, implies supremacy of the original over the derived, and this is easily transmuted into political terms. He writes: 'All ruling strata claim to be the oldest settlers, autochthonous.'⁹⁵ The official Nazi ideology sets the genuine (*echt Deutsch*) against the artificial, the import, the foreign. In Nazi philosophy, the notion of genuineness falls back on an ideologically wielded nature, and is defined in opposition to the social world. This is the fraud of genuineness and, at its base, is the economic system, which subtends all social interactions. Genuineness is not a pre-social quality, but relies on social division to sustain it. Genuineness is nothing but a swindle, a sham. The more technology and mediation invade nature and social life, the more the idea spreads 'that what exists without human interference is better than the artificial'. The more mediated existence becomes, 'the more tightly the world is enclosed by the net of man-made things', the more the mediators crow about their

own naturalness, in comparison to the mass-produced commodities that surround them. Adorno notes:

The discovery of genuineness as a last bulwark of individualistic ethics is a reflection of industrial mass-production. Only when countless standardized commodities project, for the sake of profit, the illusion of being unique, does the idea take shape, as their antithesis yet in keeping with the same criteria, that the non-reproducible is the truly genuine.⁹⁶

Genuineness is that which cannot be reproduced. Genuineness gains in value in a world of endless reproduction and synthetics, precisely because it exists no more. It is all the more loudly asserted for that. The self is assimilated to this notion of that which was never made and cannot be remade by anyone. In actuality, this self has become a non-self, an instrument of the economy, one of many standardized, organized human units. The 'livery' of genuineness is a cloak covering the absent self that the subject has become.

Within a capitalist system of exchange, commodities are meaningful only in as much as they can be made equivalent to a universal measure of value. Gold and silver have performed this function historically, with gold, because of its rarity compared to silver, the preferred measure, since the 1870s. Gold is posited as genuine, the site of value. Commodities are inauthentic, for they have meaning only in terms of their substitution by gold, that which is the measure of value, and therefore authentic. The commodity, in as much as it is an item for exchange, is not valuable in itself, but only in relation to another, as substitute. However, Adorno reveals that this appearance of value in gold is only an appearance. Genuineness opens onto un-genuineness. It is, in fact, only the mechanism of substitution. Such value has meaning only when expressed in a social, and not a 'natural' relation. Adorno writes:

Genuine things are those to which commodities and other means of exchange can be reduced, particularly gold. But like gold, genuineness, abstracted as the proportion of fine metal, becomes a fetish. Both are treated as if they were the foundation, which is in reality a social relation, while gold and genuineness precisely express only the fungibility, the comparability of things; it is they that are not in-themselves, but for-others. The un-genuineness of the genuine stems from its need to claim, in a society dominated by exchange, to be what it stands for yet is never able to be.⁹⁷

Adorno rejects the ideological construct of genuineness, by exposing its social determination. But more than this, to insist on genuineness is to make an ahuman gesture, for humanness resides in imitation, the un-genuine, the reproduced. All human life is an imitation, a learnt response, a playful

assimilation of others. Adorno embraces synthesis as a proponent of life and nature:

Anything that does not wish to wither should rather take on itself the stigma of the inauthentic. For it lives on the mimetic heritage. The human is indissolubly linked with imitation: a human being only becomes human at all by imitating other human beings.⁹⁸

While Nazi science struggled to remake the world synthetically in a quest for mastery over nature, Nazi ideology asserted the values of purity and genuineness embodied in a fetishized nature that represented purity and authenticity. Nature is the crucible of authentic experience. Nature is decreed the place of genuine experience and significant meaning. It seems to offer an experience free of social antagonism. Nature is not artificial. The more the world of 'second nature', society, industry, dominates, the more natural beauty is sought as refuge. If beauty is located in nature, then the artifice of art can be abolished. Natural beauty sees nature as appearance, never as the stuff of work and material reproduction of life, let alone science. Natural beauty is ideological because it presents mediated-ness in the guise of immediacy. Nature is made a realm without historical movement, without human intervention, a useless thing cut off from the totality of social relations. Nature is the place of value, but this is a kitsch nature, a nature made twee, attenuated to the much-needed refuge – and alibi – for the ugly and supposedly anatural social world. This prettified nature appears in tourist beauty spots and inside ornate gilded frames. Art bows before this nature: it takes its codes from her. A century of aesthetics is perverted, as aesthetics are nudged back towards Kant's veneration of nature. Kant had praised the art lover who absconds from the chamber packed with beautiful art in order to witness the beautiful in nature. This concept of beauty in nature articulated the emancipatory bourgeois critique of absolutism, with its false braids and ornamental pruning of trees, and as such it possessed critical power. Kant distrusted the artefactuality of 'second nature', of the artificial, and so he insisted on preserving the image of the first nature. He saw art as 'ministering to vanity or to social joys'. But Hegel and his generation rejected this view. Schelling's *Philosophy of Art* inaugurates a concern with beauty in art, that is, artificial beauty. With art freed from nature's spell, an increasingly stringent taboo on replicating nature emerges. The reproduction of nature in art seems increasingly kitsch. Artifice's star rose and nature was demoted. Rationalism, and perhaps even the assault on nature through industry, demoted and degraded nature. Beauty became a quality that was made. Beauty is art, that is, artifice. Adorno's *Aesthetic Theory* insists that art is the modern autonomous subject's trick against nature. Natural beauty vanished as the concept of autonomy and freedom grew. Ethical concepts were transplanted into modern aesthetics. Art is artifice and owes its

existence in its modern sense to concepts of autonomy and freedom. Perhaps that is why art became such a suspect thing in the Nazi regime with its concocted version of *echt*-nature. Art had to be banned, tamed, marshalled, censored and subjected to *Diktat*. And *kitsch* might be just the German thing to flatter the *Volk* and convey a new message about a new order, where autonomy of the self is junked and myth is reintroduced.⁹⁹ Art had once seemed to propose itself as a placeholder for all that is beautiful, true, meaningful, because the everyday world was insignificant and transient. Art was the output of an autonomous maker, an individual who could match God in matters of creation. Under modernists' hands, it was this that made art different from the world, and so art looked different to the world. Nazi art ideology demoted the artificial and venerated the natural, thereby hoping to make a continuity between the world and its artistic representation. There was to be no disruption, but rather a gentle leading into the idealized real. This venerated nature might be in the form of images, in naturalist form, of landscapes, trees that are green and skies that are blue, clouds that are white, bodies in proportion. Sometimes within these naturalistic settings great historical events unfurled, battles, political victories, acts of heroism and leadership. These appeared as if the other side of a window opened onto a world of supermen that is supposed to be *the* world, the one guaranteed by the new leaders. In Nazi art, artifice takes on the guise of nature. Art is beautiful only in so much as it imitates nature, as is indicated in these words of attack on 'degenerate artists', spoken by Hitler at the opening of the House of German Art in Munich in 1937:

Let no-one try to say that such artists really see things this way. I have noticed among the works submitted many that compel the supposition that some people's eyes fail to show them things as they really are: that is, that there really exist men who see our people of the present day only as absolute cretins, and who, as a matter of principle, perceive – or, as no doubt they would put it 'experience' – meadows as blue, skies as green, clouds as sulfur yellow, and so forth. I have no intention of entering into any argument as to whether these individuals really see and feel that way or not, but on behalf of the German people, I would like to ban any such pitiful unfortunates – evidently the victims of defective eyesight – from attempting to bluff the public into accepting the products of their distorted vision as real, or even as 'art'.¹⁰⁰

Nazi art is de-artificed and made seemingly natural. On everything else, war was declared.

Abstraction and Extraction in the Third Reich

MODULATIONS

Between 1937 and 1944 a group of former avant-gardists, Dadaists, Constructivists, Expressionists, inventors and followers of 'isms', subjected to painting-bans, prevented from displaying artworks, banished from teaching posts, and condemned by the Nazi regime as degenerate, had to seek other occupations. Their artworks were vilified for all sorts of reasons. Expressionism was reviled for using false colours and distorting the human body. Dada was condemned as an art of trash with revolutionary impulses. Constructivism was dismissed as the 'art of total madness', for its refusal to represent a recognizable figurative world. The Bauhaus was condemned as a rationalist and internationalist institution that was insufficiently *völkisch*. From the perspective of official Nazi policy on art, inaugurated immediately on taking power in 1933, there was little distinction between the 'abominations' of Expressionism, Constructivism and Dada (even if Goebbels had a taste for Expressionism, and some Expressionists – Emil Nolde, Gottfried Benn, for example – had voiced an affinity to Nazism). Dismissals from official posts and prohibitions on exhibition and practice affected all types of modern artists. Willi Baumeister was discharged from the Frankfurt Municipal School, as were Otto Dix from Dresden and Max Pechstein from Berlin. In 1933 twenty thousand museum directors and curators were dismissed. Kokoschka, Kirchner, Köllwitz, along with many more, were barred from the Prussian Academy in Berlin. Stuttgart's large Oskar Schlemmer exhibition was shut a day after opening. Schlemmer had believed that he could persuade the Nazi echelons to accept his style. He applied to join the Reich Chamber of Culture, but was refused for political and stylistic reasons. He wrote letters to high Nazi officials, pleading the case that his art was not political. He wrote to Goebbels on 25 April 1933, challenging the notion that the works of artists who had served in the Great War, some of whom had given their lives, could be branded alien, un-German, unworthy and unnatural. These were not Marxists or Communists, he insisted.¹ But he lost his post, along with others, at the Vereinigte Staatsschulen für Kunst in Berlin,

because he and some of his colleagues were condemned as 'destructive Jewish-Marxist elements' whose classes should be shunned.² A letter to Willi Baumeister at the beginning of February 1933 noted the effects of Nazi policy in the Akademie der Künste, 'where the Marxists are being forced to leave'. Hans Poelzig had been appointed director, but Schlemmer thought that 'Poelzig will probably be labelled a Communist, too'.³ In response to speeches against modern art at the start of the Nazi regime, Baumeister wrote in his diary on 24 October 1933 that its rejection stemmed from a lack of understanding. He expressed anger at the public for wanting easily understandable art.

The Nazi campaign against 'degenerate art' confiscated work by numerous artists, 112 of whom were vilified in the *Degenerate Art Exhibition* of 1937. Paintings and drawings and sculptures were seized from museums and from artists' studios. The *Degenerate Art Exhibition* toured Germany and it was to be the last-ever display of these artworks in Germany. It was designed as a 'chamber of horrors', not an art exhibition. Exhibits were crammed together messily in a few dimly lit narrow rooms, further cramped by partitions. In a seemingly homeopathic ingestion of Dada's own methods of presentation, banners, slogans and placards were stuck up on the walls. Georg Grosz's phrase 'Take Dada seriously! It is worth it' was scrawled in a sloppy hand across a wall. So confident were the curators that the artists' sentiments would be condemned by their own words, they simply reproduced lines from manifestos. Quotations from discredited art critics were cited to ridicule what was viewed as pretentiousness. Captions blurred out: 'Crazy at any price', 'Even museum bigwigs called this "art of the German people"', 'The ideal – cretin and whore' or 'Nature as seen by sick minds'. In neat gothic German script, set squarely, were quotations from speeches by Hitler and Goebbels. The displays were a jumble, and the special, segregated status of art was denied these 'degenerate' works, in a hollow repetition of Dada's own anti-art gestures. Paintings were shown alongside medical photographs, sculptures jostled with ritual fetish objects. 'Art' related to non-art, supposedly to the detriment of the former. Works were displayed according to themes: barbarous methods of representation, religious works, works that preach political anarchy and social critique, anti-militarist art, art depicting prostitutes and immorality, Expressionist primitivist art that eradicates every trace of racial consciousness by using Negro and Pacific art as a model, art in which the human figure is deformed or idiotic, the art of Jewish trash, the art of total madness (Abstraction and Constructivism). A number of artists took the opportunity to attend this exhibition of their work. Hannah Höch visited on four occasions. Her work was not on display, since selections were restricted to works in public collections. Her work had, however, been illustrated in Wolfgang Willrich's pre-text for the *Degenerate Art Exhibition*, *Säuberung des Kunsttempels* ('Purging of the Art Temple'), and she was identified as part of the 'Bolshevist' Novembergruppe artists' organization. In her journal in September 1937 she noted a suppressed, unvoiced

protest: 'All museums and public collections are represented here. After the public outcry, it is astonishing how well behaved the public is. Many faces are closed and also quite a lot of opposition can be detected. Scarcely a word is spoken.'⁴

Willi Baumeister visited twice. Four of his paintings hung there. He judged them critically, dismissing them as 'poster-like'. These were Constructivist abstractions, with recognizable figures. The catalogue showed one of Baumeister's works placed alongside work by Max Ernst and Johannes Molzahn under the banner: 'The ultimate in stupidity or impudence – or both!'⁵ Seven works by Schlemmer appeared in the *Degenerate Art Exhibition*, along with his Bauhaus portfolio. The exhibition brochure associated Schlemmer with 'barbaric representation'. By this point Schlemmer had abandoned his attempts to influence art policy in Germany. The only work desired from him at the end of the 1930s was decorative or utilitarian. He made kitschy wall decorations and camouflage paint patterns for German tanks.

Impeded in their artistry, Willi Baumeister, Oskar and Carl Schlemmer, Franz Krause, Georg Muche and others associated with the Bauhaus, Dada and other modern art tendencies were taken in by the chemist Kurt Herberts. Since 1924 he had owned a *Farben und Lackfabrik*, a varnishes, coatings and paint factory in Wuppertal called Dr Kurt Herberts & Co. Herberts was put in contact with the modernists by the architect Heinz Rasch, who was constructing some new buildings for the factory. Rasch proposed Schlemmer as a muralist and two murals were commissioned for the new buildings.⁶ In June 1940 Rasch suggested to Schlemmer that he go to the factory for three months to paint using lacquer.⁷ At the *Lackfabrik*, together with the technical and scientific staff, Schlemmer and others investigated the properties of new synthetic paints, natural resins and any coating or colouring that they could lay their hands on. They asked questions such as what were the properties of synthetic resin and nitro-cellulose and what were the possible ways of working with them? A letter from Schlemmer to Heinz Rasch on 5 December 1940 indicated how excitedly this research into materials was being undertaken. Schlemmer enthuses about the properties of varnish, asking 'Ah, varnish! – What is varnish? What is its origin?'

Varnish gleams, flows, only finally to become as hard as stone. In the process varnish can be colourless, clear as glass, as pale as water, through to yellow, golden colours, brown, right up to deepest black, just as the Japanese *urushi* lacquer is created naturally without chemical assistance. – Through the addition of coloured powder we can make any colour we like into a varnish-colour with its properties of gleaming, flowing and hardening.

Let us allow it to gleam and flow, let us allow it to make forms and become whatever form its essence pushes it to be, wherever the law of flowing compels it! If we intervene to steer its course, then something

new arises comprised of the law of varnish and human will.⁸

Schlemmer takes stock of the forces at work. The material has a will. The artist too has a creative will that can disturb the activities of the material. Chance plays a role. Schlemmer continues:

And if into such a flowing a drop jumps in, a revolutionary drop of heterogeneous material, which the river of varnish allows to run, without destroying its composition, it forces it apart, reunites it in a rainbow play or plant-natural formations, comparable to the microcosms of the 'world puzzle',⁹ but also incomparable, because these are indeed unexpected new formations without precedent. Materializations, which reflect in a mysterious manner the law of their origin here in gleam, flow and play.¹⁰

For Schlemmer, it is the material that comes to self-articulation through explorations of its properties. The artist – or scientist – is the planner of a battle, but cannot control the battle's course. The better the artist knows the material and its properties, the more wonderful the aspects that the artist attempts to release from the material. In private, Schlemmer worked on his unwanted art too. In 1940 he created a series of little pieces, *klecksographys*. In 1941 he wrote about this oil-on-paper method of splotching, inspired by microscopic photographs of natural objects such as sponges and bark and the like. He expressed the desire to paint 'from somewhere' but not from the human hand.¹¹ In May 1942 he noted that Leonardo da Vinci's advice to his students to look at a mortared wall and to discover the figures swarming there – 'He, too, sees figures "from somewhere", of unknown origin, not made by the hand of man or intended by calculating reason' and would today be considered 'Bolshevistic and nihilistic'.¹²

The matter of art, the matter of nature, the matter that is humanity, all this is resistant. It asserts itself. At least, it attempts to assert itself. Just as class struggle and resistance, denied by Nazi ideology and viciously repressed through arrests and executions, did not cease, but continued to exert pressure on the system, because people are not always putty in the hands of rulers, so too art research did not terminate, although it went under a different cover.¹³ In the heart of the Third Reich, in an industrial zone, in a state where so much painterly experimentation was banned, a factory had a staff devoted to examining the material properties of substances, and this staff, composed of former modernist artists, carried out their work through the deployment of Surrealist procedures of decalcomania and automatic painting and Romantic techniques or child's play, such as 'klecksography' or ink-blotting. These were not the technical concerns of most state-favoured painting and could take place only under industrial cover. The Wuppertal artists made cut-outs and techniques of splashing and tipping, of imprinting and rubbing, procedures

that allowed chance and process to intervene. They pressed images against glass and spilt thin varnishes on oily backgrounds. The experimenters stopped and mingled fluids, pressed materials together, made imprints, overlaid substances and assaulted surfaces. They took pleasure in the unexpected shapes and textures that emerged. They declared that they wished to release the viewer from their addiction to seeing things, their *Dingsüchtigkeit*, in its stead returning vision to optical experience.¹⁴ In 1941 the Wuppertal experimenters found an issue of 1936 of the Surrealist journal *Minotaure*.¹⁵ It contained some examples of decalomania, by Yves Tanguy, Marcel Jean, André and Jacqueline Breton, Georges Hugnet and Oscar Dominguer, published by André Breton under the title: 'D'une décalcomanie sans objet préconçu (Décalcomanie du Désir)'.¹⁶ Oscar Dominguer had shown his friends some plates using techniques that were well known in Romantic circles, and known by George Sand and friends as dendrites. Dominguer spread diluted black gouache on paper with a silk finish and he squashed another piece of paper on top. The two pieces were separated and in the images could be seen rocks and caves, the bottom of the sea, forests, stormy skies or ragged clouds. One day his friends copied his technique.¹⁷ The resulting images by Marcel Jean showed smears and swirls of paint repelling each other. Two appeared in the journal – one looked like a pitted cloudscape and one was a lush forest. André Breton's images resembled a globe of ridges, clouds and gases. Some were published in the journal. One was crammed with fuzzy shapes and one was like a microscopic close-up of dust. Jacqueline Breton's images were like crystals inside a rock that has been split apart, and the one that appeared in the journal was like a little island dense with trees. Georges Hugnet's were square and dense. Dominguer's showed fronds and columns and mouldy growth. Yves Tanguy's looked surprisingly like his own paintings. The one printed in the journal appeared as a receding horizon with waves and rocky cliff edges. André Breton's introductory gloss explained the procedure and mentioned 'the old paranoid wall of Da Vinci, but this is that wall brought to its perfection'.¹⁸

Elsewhere, then, material was asserting itself, foregrounding its textural properties, its 'unintended' aspects. The ideas that animated the experiments with coatings and paints stemmed not just from the modernist art practices that were now banned. Willi Baumeister spoke of an 'automatism of the material' that could be regulated fully by consciousness, just as Paul Klee similarly spoke of the 'life' of material. In this, they echoed Romantic natural philosophy and early German chemistry, which likewise had ordained an equality between artist and substance, convinced that substance too possessed a will.

At first the artists received an honorarium for their work at the Wuppertal factory, but later they were paid wages to carry out their experiments. Publications resulted from their research. The experiments with materials were placed in a cultural-historical context in a number of publications,

relating the images to ice-age paintings, extra-European works and post-Cubist developments in painting. Thereby links were drawn to traditions negated by Hitler's simultaneously anti-primitivist and anti-modernist *Kunstkritik*. Work was carried out according to Schlemmer's maxim on pure painting in 1935: pure painting is the unintentional, mistaken flecks on a palette or an offcut. The first publication in Herberts's series appeared in 1938 and was titled *10 000 Jahre Malerei und Ihre Werkstoffe* ('10,000 Years of Painting and its Working Materials'), a study of art history from the perspective of techniques and materials. Then, in 1940, came Herberts's *Dokumente zur Malstoffgeschichte*, and, together with Schlemmer, *Lackierkunst im technischen Zeitalter* ('Lacquer Art in the Technical Epoch'), and, with Baumeister, *Untersuchungen über die Anwendbarkeit historischer Malverfahren* ('Studies in the Applicability of Historical Techniques of Painting'). In 1941 Baumeister helped Herberts with *Anfänge der Malerei: Die Fragen ihrer Maltechniken und das Rätsel der Erhaltung* ('Beginnings of Painting: The Question of Painting Techniques and the Mystery of Conservation'). In 1942 Baumeister, Schlemmer, Rasch and Herberts worked on *Aus der Maltechnik Geboren* ('Born of Painting Technique'). After this collective work, they decided to devote a whole volume to the questions that had arisen while working on experiments for that book, and called on Franz Krause for help. Once the Wuppertal experimenters had found a copy of Friedlieb Ferdinand Runge's book *Bildungstrieb der Stoffe*, they considered calling this new book *Bildungstrieb der Stoffe*. In a manuscript draft Baumeister wrote: 'It is the drive to formation of elements [*Bildungstrieb der Stoffe*] that can be led to a rich unfolding.'¹⁹ Curiously, Runge's images bore striking similarity to some of Schlemmer's images of 1940–41 using chemically antithetical colours, although Schlemmer seemingly had no knowledge of Runge at that time.

Images derived from procedures connected with *Aus der Maltechnik Geboren* were supplemented by more experiments begun in 1943 amid air raids in this densely industrial part of Germany – in June many materials were destroyed by bombing. Baumeister's diaries show that even through the difficult times of aerial bombardment countless experiments were undertaken. The experimenters had at their disposal numerous items, such as East Asian, Persian, Indian and European lacquer boxes, Egyptian mummy coffins and painted Baroque cupboards, to help them in their reflections on colouring and matter's composition and 'drives'. In April 1944 they decided to include chemical modulations. They made more images, using all the techniques of dripping and rubbing and pressing and shaking and introducing incompatible substances to each other, and then selected 52 experiments out of 142. The title *Modulation und Patina* was chosen for the project, for modulation and patina were the two forces under investigation. In addition to the images derived from materials were photographs depicting these two phenomena. *Modulation und Patina* cherished natural beauty alongside chemical wonders. There were images of the patterns left by the sea and sea

scum on wet sand. There were ice flowers on windows and a close up of the markings on a lily petal. There were water puddles on asphalt and dilapidated paint on wood and a tree-trunk burnt to perforated carbon. There were bubbles and folds and slashes of paint that had been heated and become elastic or crinkled or cracked. There were the effects of weathering on light paint on a dark background that had been pitted to hold paint better. Of fascination was the fact that in nature and on artisanally worked surfaces the same phenomena could be observed. They also included some prints: a klecksography from Justinus Kerner and a torn paper image by Christian Morgenstern (which reminded Baumeister of Arp) and four dropper images from F. F. Runge. Not only did a secret art practice persist under cover of science, the unfurling of art's logic was developed. Baumeister wrote to Rasch on 21 September 1943: 'More and more I realize that with mod and pat you have singled out a great aspect of contemporary painting, present in everything. Yes, it is probably the kernel of the technical issues of modern painting.'²⁰ The pursuits of *Modulation und Patina* were not the only technically modern practices in which these quiet subversives were engaged.

IMAGE SUBVERSION

The *Degenerate Art Exhibition* was confronted by its antithesis, the *Great German Art Exhibition*, opened one day before and staged in the House of German Art, a monumental purpose-built gallery, with 100 metres of close-set encasing columns at its front. The Nazis had their own cultural programme to replace the void left by the purging of 'cultural Bolshevik', Jewish, degenerate modernism. The images on show included oil paintings of Nordic beauties, uniformed men at battle, peasants at work in the fields or relaxing in their homes, tended by their wives and children, great moments in the nation's history or the Nazi party's history, nudes in Arcadian settings, pictures of great technological achievements, figures engaged in athletic activities, statues of supermen and portraits of members of the Nazi hierarchy and Hitler. Paintings and sculptures were positioned so as to show them off solemnly and grandly. They were great propaganda pieces for the spectacular power of the regime. The favoured neo-classical styles were to link them to the art of ancient Greece, another great empire, which Nazi scholarship had deemed to be Aryan, and, as such, part of the heritage of Nazism. German Nazi art symbolized eternal value. It would last for a thousand years and more, and so by implication was ever there, and yet it denied time within itself, in that it claimed to bear no relationship to aboriginal sources, being a product of pure 'Aryan' refinement. Antiquity was evoked, setting Nazi achievement in relation to duration or eternity. Time figured prominently in Hitler's speeches on art. Modernist art, and its criticism, accented time, simultaneously connecting to the fashions of the moment – 'art and art activities are lumped together with the handiwork of

our modern tailor shops and fashion industries' – and to ancient time, the Stone Age, favoured by the 'pre-historic spluttering art brigade' with their primitive international doodles. Nazi art was eternal and not modern, but never primitivist. Its art moved forward, forging the nation of the future. History and value began with the great martial empire of Rome and the rigours of Sparta. Primitivism, something referring to a time before these hierarchical social formations, was the equalizing domain of the modernism it despised.

As Clement Greenberg argued at the time, the official art of the Nazis was actually kitsch. It used for raw material the debased and academicized simulacra of genuine culture. Kitsch was the culture of mobilized masses (ready for rapid industrialization and war).²¹ It was a genuflection to mass industrialized taste, and kitsch as word seemed to evoke something that was sloppily put together, synthetic. For the regimes of the 1930s, kitsch was an efficient vehicle of propaganda, ideologies, sugar-coated stories of nation and heroes, and an inexpensive way to tug the heartstrings of the masses. Photographic, mass reproduction played its part in Nazi art. After visiting the yearly *Great German Art* exhibitions each visitor could take a piece home, for the production of postcards was on a massive scale. For minimal cost everyone became versed in the Nazi syntax of art. Heinrich Hoffmann, Hitler's official photographer, held an informal monopoly on art reproductions. Postcards, along with other types of reproduction such as magazines and stamps, disseminated the new art forms and their ideals. Pocket-sized, the mass-produced postcards of official 'art' might conveniently convey a grand image of fantastic power and a hunk of sales pitch. These ideal images conjured up naturalness, sport and strength, and so laid the basis for a compact Nazi ideology founded on race and domination. The purveyors of modernist 'isms' delineated bodies that were garishly coloured and distorted. But perhaps, Hitler conceded, this was indeed a representative body type in the degenerate Weimar Republic, now to be overcome, for 'the new age is shaping a new human type'. Young German bodies were trained to be sleeker, stronger, more martial and fitter. This brought them closer to antiquity and they appeared in a form that had scarcely been imagined for a thousand years. This was a new body that had appeared in most glorious form in the Olympic Games in Berlin one year before the Nazi art exhibitions opened.²²

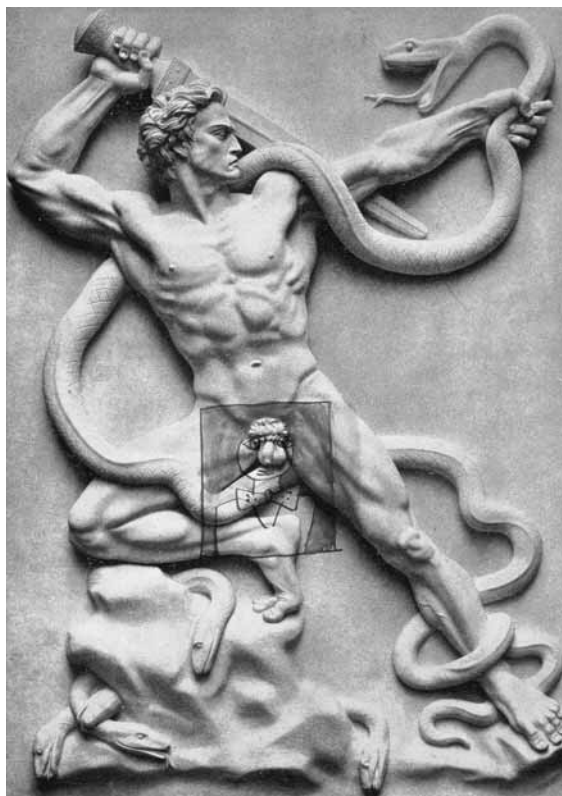
On 18 August 1938 Willi Baumeister visited the second *Great German Art Exhibition*, ironically noting in his diary the name of the gallery, 'Haus der d. Kunst (!)'.²³ He went to the *Great German Art Exhibition* of 1942. While there he took advantage of the fact that postcards were for sale. He bought a few as well as the catalogues. In 1941 and 1942 he used these materials as the basis for collages and over-paintings sent privately to his friends such as Oskar Schlemmer, Heinz Rasch and Franz Krause. Baumeister was forced back into a tactic of artistic community-building, this time more clandestinely:

sending postcards. In 1941 he was banned from public exhibition, although he had not exhibited in Germany since 1933. He had been painting and drawing abstract primitivist shapes, sometimes using collage elements, as he had before in his Dada and Constructivist-Bauhaus phases. He investigated archaeological sources, such as ice-age painting, as a resource for his abstraction. Orientation to the ancient appealed consolingly to eternal worth, but might also serve a set of alternative values. Modern abstraction and archaic imagery had much in common, thought Baumeister, for archaism is recurrent in both.²⁴ But there was a new art game. Baumeister vandalized the surface of the postcards and catalogues that he had bought at the exhibition. The selected cards bore images by the most highly profiled Nazi-favoured artists. Postcards of works by Arno Breker and Adolf Ziegler were 'corrected' in order to denounce the type of art represented, in a manner reminiscent of Dada critique. More specifically the alterations exposed the sexualization of power and the statification of sexuality, which were crucial aspects of Nazi domination.²⁵ Baumeister acquired large numbers of postcards of Ziegler's work and his alterations played with the sexual connotations, and also the racial meanings, of the work. Ideal German women were revealed to contain mannish parts. Ziegler painted racially correct beauties of German womanhood such as were described in Schultze-Naumburg's race manual, *Nordische Schönheit, Ihr Wunschbild in Leben und in der Kunst* ('Nordic Beauty, its Ideal Image in Life and in Art') of 1937. In one alteration of Ziegler's *Terpsichore* (1941), Baumeister obscured the head of the girl with a large square implement carried by a man's hand, which stamps out her face. A hand holding an iron approaches her breasts. Breast, pubic hair and torso remained on show, along with her arm holding what looks like a rod. The girl was identified as *Jokkmokmädchen*. Jokkmok is a market village in Lapland, and so the girl was identified as originating from the extreme north, and as such a genuine Nordic beauty. In addition, bits of text, some concerning the preparation of a wall for fresco painting, were stuck on the postcard. Words, such as dampness, enthusiasm, heat, and 'after twelve hours another second ironing occurs', generated double meaning, a sexualized tinge. The exploitation and manipulation of the female body, in art, which is to say in this case in state propaganda, were brought to the fore. The girl's body is treated as a surface that is to be prepared for representation, for bearing the image of the fresco. Another time this card with its kitsch pin-up girl was used to turn the torso into a face and the pubic hair a goatee. Kitsch, the sloppily made, was turned into a principle, as new signs were scribbled on the surface. The border on the wall behind became a fabric detail. The viewer of the picture sees both images at once, switching back and forth dynamically. Three times in 1941 Baumeister set about vandalizing with a blue pen a postcard of Ziegler's *Göttin der Kunst* ('Goddess of Art'). A neo-classical form stands nude and posed like a Greek statue. Two boy underlings flank her. Ziegler was the president of the Reichskammer für bildenden Künste, and as such the highest art official in

the country. He had selected and secured works for the *Degenerate Art Exhibition*. He also helped decide which of the 16,000 items seized might be auctioned for foreign currency. Ziegler had been deemed the 'master of German pubic hair'. In each version of the assaulted postcards Baumeister turned the tuft of pubic hair into the pointy beard of a man whose goggle eyes are made of her breasts. A nose was etched onto her belly and a blue haze fades out the original head and arms of the goddess. The child-underlings were shaded such that they appeared as limbs protruding from the man's head. Scale was altered. Gender was switched. Bodies were merged. In one version these words were added: 'Mann mit Spitzbart. Von Göggels / Göbbels prämiert, Von Hitler angekauft' ('Man with Goatee. Premiered by Göggels / Göbbels, bought by Hitler'). Another caption, on Ziegler's 'Goddess of Art', declared: 'Mann mit Spitzbart RM100000 – (Porträt des Geheimrat Prof. Dr Schamhaar, Sexualforscher)', ('Man with Goatee RM100000 – Portrait of the Privy Councillor Dr Pubic Hair, Sexual Researcher'). In another instance, Baumeister tore pages from the *Great German Art Exhibition* catalogue of 1938. One showed a painting by Godron titled *Zarathustra*, and one showed Schwalbach's *Zwei Mädchen*. Hitler purchased both at the exhibition for 3,500 Reichsmarks each. The paintings were illusionistic, for they were apparently ordered and transparent. Baumeister spliced the two pictures together, placing the naked thighs and buttocks of one of Schwalbach's girls between Zarathustra and his eagle. Zarathustra's dream became less one of the superman and more a fantasy of woman's sexual promise. The super-body of the super-woman is the focus. The eagle, now Nazi symbol, looks on. In the top corner a sun rises. It was made up of Mesolithic images. The ever-rising sun evoked the cave painting that might be found inside Zarathustra's cave home. An arc is thrown from superman to first man and his art. There is no simple reading of the result, but, certainly, Baumeister's interference with the self-contained logic of the original oil paintings produced jokes and insights that Nazi ideology could not tolerate. Clarity and demonstrative unambiguity were not the aim, and the unquestioning authority of the image was assaulted. A caption adhered to the bottom of the image. It read: 'The colour chemists of industry, the artists, the scholars of Goethe's *Farbenlehre* will seize upon this book.' This stemmed presumably from one of the advance notices for a publication on painting techniques issued by the Paint and Lacquer Factory of Dr Kurt Herberts & Co, to which Baumeister was connected as researcher. Various approaches to colour and visibility sit here in juxtaposition: illusionistic Nazi-approved oil painting, Dada-esque disruptive photomontage using mass reproductions, the chemistry of industrial coatings and the empathetic nature-philosophical strivings of Goethe.

Through collage and overpainting practices, art's 'spiritual' aspirations were trashed. That is, art as spirit was challenged through emphasis on the matter of representation, matter as elements – the bits that are stuck on, the lines that form an illusion of the object and so on. The matter as subject

Arno Breker's *Avenger*
altered by Willi
Baumeister.



matter, the what of representation, was forced through over-painting and montage into question, turned dubious and made subject of innuendo. The materiality of art was set against its ideology. All the techniques were exposed as such, and their naturalism, designed to be unquestioned, turned suspect. These art games evoke Brecht's observation, in *Refugee Conversations*, about the proximity of humour and dialectics. If all this seems too serious a reading of dirty jokes shared among friends, it is worth noting that the Nazis took such frivolity seriously, and there could be vicious punishments in store for those who were caught in the act.

The public nature of the postcard, and its sloganistic economy of language, was used more directly by one resister. From the autumn of 1941 to the spring of 1942 Benno Neuburger posted fourteen postcards, bearing Adolf Hitler stamps and slogans such as 'boo to the eternal mass murderer Hitler', 'What is right?', 'terror-regime', 'never in the history of the world has such an idiot existed', 'Murderer of 5,000,000' and 'Beast Murderer Rogue'. He threw them unaddressed into a post-box in the Jewish area where he was compelled to live. The postcards were picked out at the sorting office and handed to the police. Neuburger's contradiction was discovered only when

he used a postcard that bore a frank from his former firm. He was charged with 'preparation for high treason', because he had intended to 'destroy the workforce of a Reich office that was crucial to the war effort'. He was hanged in September 1942, aged 71. Baumeister was a luckier man. Some of his postcards were intercepted by the authorities and sent to the Gestapo. Baumeister was called in for questioning and gave as excuse the fact that his postcards formed research for a technical manual on modulation and patina and the physical qualities of paint.²⁶ Something indeed connects the work for *Modulation und Patina* and the games with the postcards. The work in *Modulation und Patina* cited works of art from across the world and across the ages. Baumeister's postcard mutations expanded the range of cultural reference in the image, and, thereby, countered the homogenizing aesthetic of Great German Art, while belittling it. More generally, both undertook an investigation of surface, and a tracking of the import of alterations on the surface.

MODULATION AND PATINA

The introduction to *Modulation und Patina* opens with a discussion of a summer landscape in which everything is melted into everything else.²⁷ There is a thousandfold life and too many forms and elements for our eyes to capture. There we see modulation in all the textures and transitions of the surface. Modulation is in nature and it can be produced. A pancake is a product of modulations. It is always different, dependent on the particular *Formskraft*, power of form, and the *Bildungstrieb*, drive to formation, of materials. In the act of formation something escapes the control of the maker. It is this *Formskraft* and *Bildungstrieb* that is under investigation in the book and consideration of which can contribute to artistic technique, for modulation is also a technique in art, describing the enlivening of the surface by the particular way in which colour is laid on. Since the blossoming of the natural sciences, the emergence of physical and chemical knowledge, notes Baumeister, the world as material substance has been brought closer to consciousness. No longer are there only bodies and empty space but air too is a body, even the lightest gas has weight, and the task of the painter is to represent this *stoffliche*, material, aspect of things.²⁸ As Baumeister put it in 1947:

Modern natural science is concerned with cells, with structures, with the atom, with quanta and relativity, and biology is concerned with secretions. These things belong to a world that one cannot see naturalistically. Today's art is a complete parallel to all the intellectual branches of the contemporary period. Naturalism wanted to penetrate from the outside into the things. Today the inner construction is essential.²⁹

In representing a wave, its form should not be sculpted, but rather its dampness, movement, spray and explosivity should appear. A room or space should not be shown through the techniques of perspectival drawing but through the bringing of air and light to view: 'alles wird Substanz', everything becomes substantial.³⁰ There is more to modulation than just the simulation of a total material experience. It is necessary to know the materials involved in modulation, for modulation is a property of them. In the emergence of modulations 'die eigengesetzliche Kräfte der Stoffeswelt', the independent laws inherent in the forces of the material world, play a role. Unlike structure, modulation is unfinished. It is a process and it is a form of appearance, rather than an essential component of construction. Baumeister wrote in 1944 of the differences between structure and modulation. Structure is the construction of a thing, its composition. Water as structure is H_2O . Waves and water ripples are not structure but modulation. Modulation is a form of appearance, not essential to construction, though structure can be transformed into modulation. The atmosphere can work on this appearance. It is harder for it to affect structure, though it may. Each colour stuff has a structure. It is the paintbrush and other modes of laying paint on that bring out modulations. Baumeister adopted the term modulation from a line attributed to Cézanne: 'Le modelé, il n'y a que cela, on ne devrait pas dire modeler mais moduler', 'modelling, nothing more than that, but do not say modelling but modulating'.³¹ By modulation Cézanne referred to the systematic transformations of colours in the picture plane and his phrase was opposed to a technique of the time, whereby objects were modelled by darkening their colour. Cézanne's transitions occur not through the mingling of colours but by setting colours alongside each other or overlapping brushstrokes. In this way colour retains its own expressive power, rather than existing in the service of the representation. Modulation traces changes on the surfaces, subtle contrasts of depth, the flow of the brush. Modulation brings the matter of painting, paint, colour, into the image, placing it as a part of the whole, which also includes that which is represented. Such practice refuses the stage-setting of nineteenth-century naturalism in favour of alertness to material properties. Cézanne commended modulation, but he was not the first to use it. It arose under many artists' hands, albeit as a secondary manifestation and not a conscious one. It is there in some Japanese landscapes of the sixteenth century. It is there in cave paintings of bison from Altamira. It is there in a Tintoretto beard, the skin of a self-portrait by Rembrandt of 1668 and in an earlier painting of the coat of an old man with a red hat. It is at work in works by Goya, the Impressionists, Turner, Toulouse-Lautrec, in Renoir's flesh, the foliage and foam of Monet and in the fields, clouds and water of Van Gogh.

Patina denotes, like modulation of which it is a type, the expressive potential of the object or substance.³² Patina is a surface appearance that is brought out by chemical, physical and mechanical processes on natural and

also artificial surfaces. Time is its agent.³³ The effects of time bring out patina as in the cracks that form on oil paint.³⁴ Patina is evidence of the effective force of nature. It arises as nature breaks into the humanly created world.³⁵ Architecture, for example, seeks perfect forms that assert themselves against natural forces. Nature and materials are subordinated to the architect's vision. But as patina they reassert themselves.

In patina we see the means whereby nature itself evens out the opposition between it and the artificial, that is to say the nature-alien, which humans erect in it. Without this evening-out we would long ago have become ghosts, trapped in a technical world. Goethe says: 'Nature is beautiful everywhere where humans have not come with their torture.' It is a consolation that nature also manages to get there where humans have erected their artificial world – as patina. Patina exposes prettiness and in certain circumstances mitigates ugliness. It is something additional that is unceasingly and eternally at work.³⁶

There is something painterly about patina, for it evens out a surface, unifying it in the way that a painter in oils often seeks. Both patina and the painterly dissolve surfaces and contours, loosening up forms. Herberts uses the example of a Gypsy group. The improvised ordering, the rags, the colourful patches and the dirt all appear as a contrast to the normal order of the world. The group appears to merge into the nature that surrounds it.³⁷ The painterly, in life as in art, is a stance that denies the individuated object nature of the world. Objects are seen instead as fragments of a material, colourful and variegated whole. The use of an object, its purpose and construction, is of less importance than the experience of the object as a material value. Patina, Herberts tells us, was particularly cherished in painting in the years 1870 to 1900, as a response to the onset of 'technization'. A glut of genre paintings at that time presented the half-finished, the broken, piles of clutter, all objects overlapping and indistinct. It countered the utilitarian standpoint with its desire for perfect, complete objects, with no trace of the human hand. Herberts, in contrast, evokes the auratic object, the object that has been used and has acquired characteristics over time. His example is Napoleon's hat, battered, crumpled, specked with grime, a familiar and loved possession. Herberts situates the love of patina historically. It arises as a reaction to a time when there is no need for patina. It is a fetish of an age where all things have technical exactness and all surfaces must be without fault and as if new. Herberts notes the aesthetic pleasure of the old town of Nuremberg, with its modulated and patina-filled surfaces that would charm a housewife. However, asked whether she would live there, she would in all likelihood say no, for the modern self seeks the smooth, exact and clean surfaces. On such 'absolute surfaces' any disturbance is seen as 'a foreign body', 'something that does not belong'.³⁸ There are two worlds, the intellectual

world of construction, absolute space with the absolute surfaces that delimit it, and another world of sensuous experience of nature, metamorphosis and modulation. The experiments of *Modulation und Patina* cherished the sensuous world, though perhaps the veneration of Gypsies (contra their abuse in the Third Reich) and the example of Nuremberg (favoured Nazi town) showed the diverse political uses of the patina's qualities.

Through references to Goethe's morphology of nature, Philipp Otto Runge's nature mysticism and his harmonic colour sphere, and Friedlieb Ferdinand Runge's chemical endeavours, the Wuppertal experimenters found their way back to the world of the Romantics, a world of interconnectedness and animated matter. The Romantic aspect was most evident in the evocation of the Romantic phenomenon of *Kulturlandschaft*, the culture-landscape. This denotes a fascination with ruined buildings that have been invaded by nature, by weeds and trees and plants that cling to their broken surfaces and nestle in gaps. Nature reclaims the artificial, and the two meld into a single beautiful vision, so beloved of Romantic painters and sketchers. Something about them denies the grubby monetary basis of capitalist society. Culture landscapes evoke an image of what appears to have been lost, a fantasy image, but a compelling one, of a pre-modern world that was less cruel.³⁹ Presented in *Modulation und Patina* is a world that hangs together, in *Zusammenhang*. Material turns to dust and matter to crystal, and then, by itself, forms plants and animals, as Schopenhauer insisted.⁴⁰ Goethe's idea of metamorphosis was crucial to this vision of nature. All is connected. All form is in movement, in passing, in becoming, in transition. Modulation is one marking of this transitoriness. It is nature speaking. It is materiality asserting itself. Modulation returns the world to one manifestation, one enlivened substance, acting and interacting. Modulation shows the unity of the whole and the transformations in separate parts. The conclusion of *Modulation und Patina* quotes Novalis's *Die Lehrlinge zu Saïs*:

Men travel by different paths. Who ever tracks and compares their ways will see wonderful figures arising; figures that seem to belong to the great Manuscript of Design which we descry everywhere, on wings of birds, on the shells of eggs, in clouds, in snow, in crystals, in rock formations, in frozen water within and upon mountains, in plants, in beasts, in men, in the light of day, in slabs of pitch and glass when they are jarred or struck, in filings around a magnet, and in the singular Coincidences of Chance. In these things we seem to catch an idea of the key, the grammar to this Manuscript.⁴¹

There is a language of nature to be learnt. There are also new ways of seeing. The final words of *Modulation und Patina* reveal that vision could be trained and that it was the 'task of the human to school his eye and his perception for the correct co-experience of this world of appearance'.⁴²

For the Wuppertal experimenters this sublime in nature is not apparent, as for Kant, in the vision of the turbulent sea, the snow on the highest mountain peaks, massive ice floes, a looming dark mountain, a sudden chasm, or the Milky Way, perceived with terror, as the mind realizes the immensity and indifference to humanity of that which is perceived. Rather it is found in the wind-rustled surface of sand or the crackled exterior of a trunk, in the warped paint on a door, the pitted superficies of a concrete wall or the splattered drops of an oil unable to mix with its background. The beautiful in nature, as in art, is found at a micrological level.⁴³ Here is presented a graspable nature, accessible through an art practice that is simultaneously child-like, primitivist and open to chance, as much as it is modern in its embrace of material properties and the merits of change.

ROCKET MEN

For the Nazis, art imitated the external look of nature. Science and technology improved on nature, bringing progress to humanity through the laboratory creation of better substances, colours, textiles. But the goal of science and technology was the ensuring of victory in war, which is, in effect, an assault on nature, on landscapes as on life. This was the Nazi materiality beneath the ideology of nature, blood and soil. As war advanced, so too did scientists' inventiveness. The sublimity of the skies was to be ripped up.

By the Baltic Sea, at the northern tip of the island of Usedom in Pomerania, north-east Germany, Peenemünde provided the testing ground of the v-1 and v-2 weapons. The v-1, commonly referred to as buzz bombs or doodlebugs, were bombs with wings, 900 kilograms of explosive flying at speeds estimated between 500–700 kilometres per hour at an altitude of about 600 metres. Once they reached their destination, having reached a specific number of revolutions of the small propeller that was attached to the nose, they were programmed to dive suddenly to the ground. An airfield was built at Peenemünde in 1936 as a test site for the Luftwaffe. Airplanes with rocket propulsion, take-off assistant rockets, guided weapons, especially the 'flying bombs', zoomed over its grey runway strips, the Baltic Sea its hazy backdrop. Test firing of the first v-1 occurred in early 1942 and the first v-2 on 3 October 1942. It took time to make such weapons effective. Weapons testing was crucial, and here they could be tested without danger, fired into the Baltic, 300 kilometres of open sea that surrounds the island, dotted only by a few little parcels of unpopulated land. Upon splashdown, they released a bag of intense green dye to mark their location in the water. These rockets had their utopian ancestors. In the 1920s rocket enthusiasts had dreamed of rockets that would reach the moon. These were cosmic machines destined for interplanetary exploration. The dream was not realized, despite the many attempts of hobbyists. In 1929 Fritz Lang released the film *Woman on the Moon*. The scientific advisors helped them to imagine

this future of space travel, with the need for a rocket to achieve orbital escape velocities, the fact of lower gravity on the moon and a depiction of zero gravity. The plot entailed the discovery of vast quantities of gold on the moon, which the lunar explorers set about mining, dressed in their woollen sweaters and *Lederhosen*. In 1928 the rocket designer Herman Oberth started to build a high-altitude liquid-fuelled rocket, to be launched on the day of the film's première as a publicity stunt. But he failed and slipped back into the shadows until 1938, when he began to work on military rocket development for the Germans at Peenemünde. Oberth and other rocket scientists turned their attention away from the moon and towards military research. The dream of the flight to discover other worlds turned into the nightmarish destruction of this one. Research into the use of rockets as a weapon began in the early 1930s, for the Versailles Treaty, which demanded disarmament and prohibited weapon manufacture, did not mention rockets. But once the Third Reich came into being and conventional weapons manufacture began, there was no special interest in rocket technology. It was not until the early 1940s, in desperation about the course of the war, that the Nazi regime began to devote resources and money for research into rocket science for a new type of weapon.

These flying bombs, these whizzy rockets fuelled by liquid oxygen and alcohol, were considered by the regime to be retaliatory weapons. The Nazi story was that the weapons developed at Peenemünde were developed out of revenge, hence the name v-1 and v-2, *Vergeltungswaffen*, retaliatory weapons. The British, claimed the Nazis, began the aerial bombardment of cities and visited destruction on civilian populations. In truth the Nazis and the Allies alike had been bombing cities from manned aircraft since 1940. The Nazis had targeted Rotterdam and London nightly for months, and there were British officers in the RAF who believed that the war could be won by air power alone, and who pushed for a bomber offensive. Large numbers of workers were enlisted to aid production of the Nazis' new series of long-range weapons. Some were forced labourers, some were paid. In time, foreign workers were drafted in from concentration camps, many thousands of them at any one time, producing the weapons that were tested in various areas in the neighbourhood. Some worked at the oxygen factory. In order to launch the rockets two solutions were needed: 98 per cent alcohol, which was derived from potatoes, and liquid oxygen, which was necessary to burn the alcohol. The potatoes were taken from the living to make death. The oxygen was taken directly from the air around the building, using machinery that had originally been developed for the production of ice. Air was subjected to a high-pressure process and then divided into its component parts. The oxygen was frozen as liquid at -183°C . From July 1942 this plant was in operation around the clock, with three shifts producing 13,000 kilograms of liquid oxygen every day. For each rocket launch 8,000 kilograms were needed. The factory itself was a huge user of energy.

British intelligence found out about the work at Peenemünde, perhaps tipped off by the Polish Underground Army, and some reconnaissance planes flew over the area to locate sites for bombing. In May 1943 Flight Officer Constance Babington-Smith, a member of the Allied central photographic interpretation unit in London, studied an aerial photograph and interpreted a tiny, curved dark shadow as a ramp and a little T-shaped spot above the ramp as an airplane without a cockpit. She had seen the V-1 bomb. Three areas were pinpointed for bombardment, in order to put both scientific research and production out of operation. After that there were a number of heavy air raids, including an attack by almost 500 RAF heavy bombers on 17 August 1943. The bombs went astray. They hit some of the scientists' homes and some researchers were killed. But the major death toll came from the explosions at the foreign workers' camp nearby. Five hundred people were killed, though it was of little concern to the Nazis at that point since they could simply get hold of more workers from concentration camps to fill their places. The damage to the installations was not heavy and the plant was running again soon afterwards. But there was one major consequence of the bombing. The production of rockets was relocated. It was taken into nature's heart, underground, down into the Harz mountains, at Nordhausen. Goethe had set a scene in *Faust* in these mountains, where the light was curious and known as the *Brocken Gespenst*, the Brocken spectre. A visit there in December 1777 led to some observations in his *Farbenlehre* on optical effects as the sun was about to set:

and its rays, greatly mitigated by the thicker vapours, began to diffuse a most beautiful red colour over the whole scene around me, the shadow colour changed to a green, in lightness to be compared to a sea-green, in beauty to the green of an emerald. The appearance became more and more vivid: one might have imagined oneself in a fairy world, for every object had clothed itself in the two vivid and so beautifully harmonising colours, till at last, as the sun went down, the magnificent spectacle was lost in a grey twilight, and by degrees in a clear moon-and-starlight night.⁴⁴

Goethe perceived the oppositional and harmonizing logic of light and shadow. His scientific observation took place in a fairyscape. The Brocken spectre was also the name for a peculiar optical effect that terrified climbers until it was scientifically understood. The shadow of an observer is cast onto a layer of mist or cloud, appearing in extra-large dimensions and, as the wind blows, it seems to jiggle. In later times the same effect could be observed as aeroplanes cast their shadows onto clouds. By then, the light in the Brocken was occluded and tunnels were bored into the mountains, to make an underground factory called Mittelwerk. Inmates of the KZ Buchenwald staffed these double-death factories. Before the weapons of death were produced, the

inmates were worked to death. French, Ukrainian, Polish, Russian and Czech prisoners were overseen by *Kapos*, camp police, many of whom were German criminals and themselves prisoners, and so also under the orders of the ss. Some prisoners built roads, laid tracks or dug pits and others built the factory, cutting through rock, shifting the unshiftable. Most prisoners were housed in the tunnels themselves during their construction period. There was no water and the straw sacks they slept on were lice-ridden. Of the 17,500 prisoners who arrived at the camp between the end of September 1943 and 31 March 1944, 6,000 were dead at the end of March. At Mittelwerk two tunnels stretched more than 1,800 metres, at a breadth of between 9 and 11 metres and a height of around 7 metres. Forty-six cross tunnels connected these two major routes. At the end of December 1943 the production of v-2 rockets began in the tunnels. The ss sent further prisoners to build the concentration camp to house the workers who would supply the factory once it was in full operation. In May 1944 everyone was moved from the tunnels into the new Camp Dora. The foreign and German prisoners producing rockets worked twelve-hour shifts, on little food, and guards beat them, sometimes to death. Towards the end of the war, as the East fell to the Soviets, evacuees from Auschwitz and Gross-Rosen arrived; among their number were many dead and dying. The crematorium at Camp Dora was not large enough to cope, and makeshift bonfires were improvised. Corpses littered the area. In the nearby camps of Blankenburg, Harzungen and Ellrich, Hans Kammler tried to implement a plan of placing the entire German aero-industry underground and he began to erect new underground factories under the Kohnstein and other mountains. This led to many deaths, mainly among prisoners sent from Buchenwald in the spring and summer of 1944. These victims were burnt at Dora. There was a period of respite, from the middle of 1944. German political prisoners took over the internal management of the factory. It was imperative that rocket production continue and so the ss were obliged to hold back on violence and death in the factory. By now, the tests had become reality. Weapons were transported to the Belgian coast and Pas de Calais for launching. The first doodlebug hit England in the middle of June 1944. By the end of the month they hit some 50 times a day. The first v-2 rocket came in September 1944. The flight from The Hague to London took four minutes, the starburst rocket travelling through the atmosphere at the speed of a rifle bullet, trailing vapour. The actual impact of v-1 and v-2 rockets was not of huge military significance. It did not advance Germany's war aims physically, just as Allied aerial bombardment did not bring about the economic collapse of Germany as predicted. The weapons were part of a psychological propaganda war. The German press argued that these weapons and fear of what was yet to come smashed British resolve. At the same time, Germans were to feel proud that their countrymen had developed such terrifying weaponry. At the beginning of 1945 the former ss camp-commandant from Auschwitz took command at Dora and a period of repression set in. Key

'Reds' were arrested and accused of sabotage and resistance. In particular, Soviet prisoners were hanged in the area where daily roll calls occurred. Around 20,000 prisoners failed to survive in this camp. The cave's treasures were deadlier and deadlier now. Some hangings took place in the factory itself. Even on the day of the camp's evacuation, on 4 April 1945, the ss executed seven Communists in the camp prison.⁴⁵

The factory stopped production on 1 April 1945, ten days before the arrival of American troops. Once word got out about the factory and its productions, senior American representatives from Senate and Congress visited. They were most interested in the factory and the technology that had been used in the construction of the rockets. The zone where the camp was sited was to go under Soviet control, and the Americans had to work quickly to seize the weapons technology. The hand-over of land was delayed while the Americans loaded the remaining 100 v-2 weapons onto trains to take them away to Antwerp, where they were packed onto ships and transported to White Sands, New Mexico. In June 1945 the scientist Wernher von Braun, technical director of the installation at Peenemünde, would follow his rockets, and was soon to start working for the US military and then NASA. One hundred and twenty-six of his co-workers went with him, while Herman Oberth later ended up at Huntsville, Alabama. This was the export of German science, the technology and the technologists displaced to the New World, where, at the close of the war, three-quarters of investment capital and two-thirds of world industrial capacity were concentrated.

Another project came to an end. In Wuppertal, in a state where reified, fake, unmediated nature, the nature of 'blood and soil' was used as legitimization for spilt blood and scorched earth, investigations into material properties at the *Lackfabrik* could take on some significance as a project in which nature, now much abused and ideologically manipulated, had been given voice to speak back. *Modulation und Patina* was completed by the artists at Herberts's *Lackfabrik*. The print-ready material was sent, together with a sketch of the layout, to a Swiss publisher on 8 December 1944, for the war and its demands meant that it was impossible to publish the material in Germany. They had tried to present the work as *kriegswichtig*, essential to the war, but in these closing months, as Nazi defeat was apparent, that argument could not be won. Once the end of war came, in the spring of 1945, there were too many questions about the future and plans for publication of the book were abandoned.⁴⁶ An abstractionist art practice carried out inside Nazi Germany, with its loudly proclaimed and officially sanctioned hatred of modernism, slipped from view again.⁴⁷ Something else had been obscured too. Herberts & Co., which had been making camouflage paints and other useful substances for the war effort, was one of thousands of firms that had used slave labour.⁴⁸ At the end of the war, the International Tracing Service researched concentration camps, including those in which 'civil workers' or forced labourers and pows were held. The names of the firms that used

forced labour, many of them leading ones, were missing from later catalogues of shame.⁴⁹

AFTER WAR, THE COLOURS OF VICTORY

Within Germany the scientific booty was to be shared out among the victorious allies. Much lay in ruins after the aerial bombings of 1944 and 1945. To prevent disease spreading and to rebuild a post-war economy, the IG Farben factories had to start working again quickly. The Allies occupied the factories. On 11 May 1945 the occupation authorities distributed the first production permit. IG Farbenindustrie AG's 2,000 firms were confiscated and the cartel dissolved by Allied powers on 5 July 1945. Iron, steel and coal industries and the large banks experienced the same fate. The various firms were divided up between the Allies according to the zones each one controlled. At Bayer, for example, the works at Leverkusen, Elberfeld, Dormagen and Uerdingen passed to the British. Leuna, Schkopau, Bitterfeld and Wolfen were given to the Soviet government. BASF Ludwigshafen was under French control. Hoechst, Griesheim, Offenbach, Cassella, Kalle, Behringwerke, Bobingen, Gersthofen and Wacker were in the American zone. IG Farben had 40,000 patents, and thousands of trade marks. These were seized. Technicians and scientists were interrogated for their technical knowledge. The Economics Division of the Military Government, staffed by men from finance and big industry, had little interest in the accusations made at the IG Farben trial, or in the revelations about slave labour and atrocities. The cartel agreements with DuPont in the us and ICI in Britain, and the existence of an American IG Farben and the wartime links between IG Farben and Standard Oil in the us and Royal Dutch Shell in Britain were exposed. So too was the fact that IG Farben received money for every litre of aeroplane fuel produced in the us and delivered to Britain.⁵⁰ The crucial people in the Industry Branch were also largely industrialists and there were cases where they locked the workers out of factories and forbade the formation of unions.⁵¹ There were attempts to hinder the trials, at which several leading IG Farben directors were to appear, charged with crimes including the planning and execution of attacks against other countries, expropriation of property in the military occupation of Germany, and participation in war crimes against humanity by enslaving civil populations in occupied territories.⁵² In the end, some of the accused were excused and some were given short penal sentences. No one was charged with the planning and participation in a war of attack. The managers were back in the industry very quickly.⁵³

Richard Sasuly's book on IG Farben was published in 1947. In it, he notes: 'The magic of IG synthetics would become the property of the nations which won the war against German fascism.'⁵⁴ Sasuly was the head of financial intelligence and liaison of the Finance Division of the United States Military Government. At first the us occupiers were interested in gold reserves and

materials held in banks. The claim on IG Farben was manifested in an interest in Poeltzig's premium Frankfurt building, which had not been bombed during the war, though much of the rest of central Frankfurt lay in ruins. The US occupation authorities wanted a base here, but the Frankfurt administrative offices had been occupied by 10,000 'displaced persons' who, to keep warm, had burnt countless files and documents. The building was cleared and in the process many more file cases and papers were dumped in the corridors and grounds. Investigators waded ankle and waist deep through reams of paper in pursuit of the historical record.⁵⁵ From their reports based on these documents, on interviews, on files excavated from the gardens and cellars of IG Farben directors, Sasuly pieced together the story, for: 'The chance to write the story of IG Farben was in every sense a by-product of victory in the war.'⁵⁶

Senator Claude Pepper's preface made it clear that the book was an indictment of what he called 'IG Farbenism', that is, cartels and monopolies. For him: 'the German war maker, in a real sense, was not so much Adolf Hitler's brown-shirted, swaggering storm trooper, as it was the soberly-clad superficially honorable type – Hjalmar Schacht or Hermann Schmitz, president of IG Farben.'⁵⁷

Sasuly's story became one of the sources for a film, made by the new GDR studio, DEFA, in 1950. The film *Der Rat der Götter* ('Counsel of the Gods') was directed by Kurt Maetzig. Using Sasuly's *IG Farben*, documents from the Nuremberg trials after the war, and reports on an explosion of dimethyl ether in a chemical factory at Ludwigshafen in 1948, which killed more than 200 people, it tells the story of three people who work at IG Farben. There is a chemist who naively produces poisonous gas for Auschwitz, his class-conscious working-class uncle Karl, and the director of the concern, pseudonymized as Geheimrat Mauch. The film underlines IG Farben's profits in war. German industrialists are indicted for their role in war and their liability for the deaths in the concentration camps. The explosion in Ludwigshafen after the war is blamed on the continuing, post-war production of explosive rocket fuel for war. Where Sasuly had railed against the trusts and cartels, in favour of a free market in chemicals, the Communist politics of the film associated IG Farben with capitalism *per se*. The film represented the GDR line: capitalism in the form of big business produced fascism, and profited from it. The Cold War's stand-offs are encoded in the film. All through, IG Farben are in close collaboration with Standard Oil. The US representative is a vulgar cynic. Big business had not been penalized or eradicated in West Germany and the USA, and so the danger of recidivism persisted. Only in the Soviet zone was fascism extinguished, according to the Stalinist line. Among the fictional reconstructions of IG meetings, work in the laboratory, family discussions and love entanglements, there are eight documentary segments. The film asserted its authenticity (despite the use of pseudonyms). It did this through documentary images of Hitler, explosions, refugees, death camps and a peace demonstration from 1950, at which, in a melding of reality and

film, the fictional hero of the film, the chemist, who turns against his employers, participates. The fictionalized reality is overlaid by the power of the document, a mechanical and indisputable witnessing of horrors and future hopes.

The ex-Nazi Karl Aloys Schenzinger published his account of IG Farben in 1953, and it was a story without remorse. It was written in a spare style, familiar from his earlier popular science novel *Anilin*. The story did not trace the ways in which synthetic science led to war and scientists abnegated responsibility. Rather it was the tale of the necessity of chemical development, of synthetic fertilizer, of pharmaceuticals and of Buna rubber. Schenzinger writes of the Wall Street Crash in 1929 and how this affected the chemical industry. IG Farben's 110,000 employees and workers were reduced to 63,000 in 1932, and those employed only on a five-day week. The Nazis came to power and brought work for all. They banned work-saving machinery and established building projects, such as roads through the mountains and motorways. But they also brought 'intolerance', notes Schenzinger, with some regret.⁵⁸ The book closes with a discussion between a military doctor and an army major. The doctor despairs that in the end everything leads to destruction, not salvation. Alfred Nobel created his prize because of his guilt about the fact that his dynamite was not used to build pathways through mountains, but was used rather for killing. The aeroplane too had promised to bring peoples together, but instead it brought the destruction of cities. Artificial saltpetre promised doubled harvests and instead it was used for munitions. The army major responds by saying that technology and science have no morality. Inventions are used to destroy the enemy in order to save the self. All living beings, he observes, subsist according to that principle. This instinct is stronger than any ethics. It would seem that the major, or perhaps Schenzinger, is unable to abandon a type of thought predicated on a narrow version of 'brotherly love'. The world is at war, permanently, and hatred is the truest emotion. But the major is practical. Keep working, he says, and do not despair. And this is what they do. In the closing lines of the book the doctor returns to his petri dishes and the major goes to the front, 'where he is still missing'.⁵⁹

Hollywood had already contributed its first account of the post-war European order. The film *Berlin Express* of 1948, directed by Jacques Tourneur, was the first American production to be filmed in Germany after the war. A German, Dr Heinrich Bernhardt, is travelling to Berlin to promote the idea of German reunification, a plan that is sponsored by the US State Department. He is kidnapped on the Paris–Berlin train. His secretary requests help in finding him from representatives of each of the Allied nations. And so a Russian, a British man and the hero, an American, wander through the dark and twisted ruins of Frankfurt and Berlin in search of the good German. Location filming among the ruins attests to the severity of the urban destruction. The film noirish codes of the film turn filmed reality

back into expressionist nightmare, and the fictionalized scenes in a nightclub with a mind reader and a clown who is an enemy spy intensify the menacing atmosphere. The enemy is not named. It could be residual Nazis or Communists. At the end of the film a few gestures attest that the Soviet lieutenant's attitude is the greatest threat to peaceful cooperation. The Cold War fronts are solidifying. The post-war world is the real subject of the film. There are good Germans, such as the kidnapped doctor, who was a part of the anti-Hitler underground, and there are bad Germans, such as the kidnappers, whose politics and motives are not spelt out, but who can be beaten by the antics of the allies. But can there be good Russians? The US film also asserted its authority by adopting documentary conventions. A voiceover ruminated on the state of post-war Europe in a documentary segment. The band of Allies visits the IG Farben building in Frankfurt to discuss matters with the US occupying authorities. Viewers see the bustle involved in re-establishing a workable post-war German order. Over footage of the IG Farben building's exterior and interior the narrator says:

The IG Farben building, monument to German ingenuity and might, former administrative home of the gigantic Farben industries, manufacturers of the tools of war. The boys in the Allied bombers also looked after this spot to see that it wasn't touched because here where the munitions makers performed their paperwork for the conquest of the world, here would be ideal offices for the enforcement of the peace. Here would be headquarters for USFET, United States Forces European Theatre. Here the American soldiers are helping to form the history of the world today, to keep the peace in Germany, to make it possible for the people to resume their place in society. The army of occupation is on constant duty and no city is more important than Frankfurt, clearinghouse, nerve centre and main hub for the entire American zone. This was Congress, the White House and the Department of Justice combined under one roof. Here policy was made and executed, work permits granted, travel orders rewritten, checked, and enemies of the government were called to account.

IG Farben becomes, again, the site of a massive concentration of power. Here the future is made bureaucratically. It also had to be forged ideologically. A book of 1946 by James Burnham, a former Trotskyist turned liberal anti-Communist and geo-politician, *The Struggle for the World*, opens with this sentence: 'The Third World War began in 1944', and he expands on this with reference to the mutiny by Greek sailors and soldiers at Alexandria.⁶⁰ The British Army quickly crushed the mutiny, but Burnham thought there was something of general significance in the event. The mutineers were members of the ELAS, the military wing of the Greek Communist Party-controlled EAM. As such there was Communist influence, which is to say

influence from the USSR, still an ally of Britain at that point. He concluded then that a different war was also in process: 'the armed skirmishes of a new war have started before the old war is finished'. That new war of course is the Cold War, or its pre-skirmish, the battle for political and economic domination in a carved-up Europe. Burnham's book announces the US intention to overcome Communism, and any other threats to US supremacy, actively promoting a more aggressive strategy, called 'liberation', to undermine Soviet power. The US must defeat the USSR, even if this means striking 'an immediate paralysing blow with atomic weapons at the Caucasian oilfields, Moscow and a dozen or more of the chief Soviet and Soviet-controlled cities and industrial concentrations'.⁶¹ This work found resonance in the highest political quarters. Burnham noted in the first essay in *The War We Are In* (1967): 'The analysis of communist and Soviet intentions in Part I of *The Struggle for the World* was originally part of a secret study prepared for the Office of Strategic Services in the spring of 1944 and distributed at that time to the relevant Washington desks.'⁶² He repeated his claim about the Third World War beginning in 1944 in the first lines of *The War We Are In*. When Burnham diagnosed a new aggressive period in Soviet politics, he was not necessarily wrong, but it did mean that the revolts and mutinies of that period were disregarded or made sinister, characterized as part of a Soviet plot. This enabled the post-war, Cold War world to come into being as a stand-off between regimes. Effectively, in this moment, a certain post-war settlement was being worked on – the parameters of a post-war world, which was explained in terms of ruling-class spheres of influence, divided between rulers who rule over people, whether in the name of 'democracy' or in the name of 'the people' themselves.

Europe was ruined, but US money in the form of the Marshall Plan could reanimate the factories and offices. In the Allied nations demands for a new post-war settlement for everyone were raised. Workers and soldiers remembered the lack of material reward received after the First World War. If the booty of Germany was to fall into their rulers' hands, they too wished for a share. Something had to be promised and even delivered, after all this sacrifice. In exchange for something tangible, the hearts and minds of those on this side of the line might be secured. A glance in the margins of the newspapers at the close of the war reveals something of the grinding texture of everyday life: death notices in the Roll of Honours, artificial limbs and the chemical eyewash solutions for work-weary eyes are the stuff of the small ads. There are hints on how to cope with rationing and shortages and there are monochrome C&A advertisements for Fibrene dresses in all of two tones of grey. All the colour has bled from Europe.

After Germany: Pollutants, Aura and Colours That Glow

FREEZING AND DYING: THE POST-WAR COLD WAR

There is a rumour about Walt Disney. It alleges that following his death on 15 December 1966, from acute circulatory collapse brought on by complications from lung cancer, he was frozen. Using the new technology of cryogenics and its relation cryonics ('the freeze-drying of the human cadaver after death, for eventual resuscitation'), his corpse was put in a deep-freeze cabinet somewhere – one popular location for this spurious refrigerator is beneath Disneyland's 'Pirates of the Caribbean' attraction. But cryonics' utopia is not a place but a time. It bets on the future. Disney lies, in decomposition arrested, waiting for the day when science can repair the damage to his body and bring him back to life. America needs him, after all. On hearing of his death, the governor-elect of California, Ronald Reagan, voiced the sentiments of all the Americans addicted to Disney's idealized vision of a world of good and evil: 'There just aren't any words to express my personal grief. The world is a poorer place now.'¹ Disney had played his part in the formation of the post-war, us-led global covenant. Alerted to Disney's death, J. Edgar Hoover ordered his name be deleted from the FBI active contact records: the Cold War had lost a warrior – at least for now. If he could only return one day, well, dreams may come true, it may happen to you . . .

Perhaps the story results from an irresistible pun. With Uncle Walt's death, the world feared that animation was now suspended. The art of movement would now lie still. Or at least that may have been what the Disney Corporation wanted the world to believe, along with the fiction that Walt Disney drew the cartoons. The cryonics rumour, first printed in 1969 in the French magazine *Ici Paris*, may have stemmed from a group of mischievous Disney Studio animators. Perhaps they partook in the same type of facetiousness as an animator and long-time associate who reputedly said that if Walt had indeed had himself frozen it was his attempt to become a warmer human being. The icy procedure was apparently practicable. Scientific speculation on hypothermia and the preservation of animal tissue through freezing had appeared in the medical and general press from the late 1950s, and the first

cryonic suspension took place just one month after Disney's death. The beneficiary was Dr James Bedford, a 73-year-old psychologist from Glendale, the very resting ground of Disney's remains.

Artificially produced life or arrested death is another output of science's supposed magic abilities. That it was refracted through images of freezing had its poetic rationale in the context of an epoch that was defined by the 'Cold War'.² In 1964 Robert Ettinger's optimistic book, *The Prospect of Immortality*, considered the practical, legal, ethical and moral impact of freezing and reviving human beings, when 'for the first time in the history of the world, it will be au revoir but not Good-by':³

The fact: At very low temperatures it is possible, *right now*, to preserve dead people with essentially no deterioration, indefinitely. (Details and references will be supplied)

The assumption: If civilization endures, medical science should *eventually* be able to repair almost any damage to the human body, including freezing damage and senile debility or other cause of death. (Definite reasons for such optimism will be given.)

Hence we need only arrange to have our bodies, *after we die*, stored in suitable freezers against the time when science may be able to help us. No matter what kills us, whether old age or disease, and even if freezing techniques are still crude when we die, *sooner or later* our friends of the future should be equal to the task of reviving and curing us.⁴

The final chapter of Ettinger's book is titled 'The Freezer-Centred Society' and it opens with the claim: 'Besides being definitely feasible, the freezer centred society is highly desirable, and in any case nearly inevitable.'⁵ He speculates about how inviting what he calls 'the cold sleep' will be to people:

On awakening, this man and his wife can anticipate at least some added decades of active life in a more advanced world; in addition, compound interest will put him in a better financial position. Why not sleep a seeming moment, and wake to a longer, brighter day?⁶

This was a real faith in the future, a future dependent on current economic relations, frozen in their image. Those in receipt of the dividends of capital delay their life and their pleasures in the name of a future promise. The capitalist-cryonic dream banks on the future. One day your cure will come, a principle that might be generalized into capital's dream-promise of abundance: one day your profits will come. But Ettinger's cryonics as redemption makes grander claims than that. The freezer programme, with the time it buys, also buys back meaning and calm in life, and, in this way, thaws out international relations and eliminates measures of desperation, such as nuclear war.

Everyone will have a jewel beyond price – a glittering physical here-after on the other side of the freezer. Heaven help Mao Tse-tung if he tries to persuade his people to turn their backs on this treasure, wrap themselves in tattered red flags, and lie down in mouldy graves.⁷

To oppose the freezer programme goes against the tenets of the Free World, proclaims Ettinger, and any such opposition is symptomatic of a mind warped by totalitarian ideology, believing that the individual is of less importance than the race, the state or society.

Ettinger was not fazed by the current unrealizability of cryonic suspension, the fact that, if a body is frozen, ice crystals form in the cells and destroy them, in a process paradoxically called ‘whole body freezer burn’, and, upon thawing, the remaining cells die because of a lack of oxygen and nutrients.⁸ He did not see human cryonics’ miscorrelation between ice and air, coolness and breath. Too overwhelming was the fantastic schema for abolishing the distresses of a nuclear world, precisely by adopting its metaphor, the chill of the Cold War. This was an image that was curiously dependent on the glaciers, excluded in cartography and political iconography because they disturb the East-West settlement, where the two superpowers almost touched at Alaska and Siberia. And it imagined the solution through a type of stand-off, a permafrost stasis until science had caught up with the dream. The life so preserved was neither dead nor alive, but teetering forever on the brink of death, technically alive, but unable to decay, or transform, unable to get better. It is out of the hands of the body and in the clasp of science. This is, at least, a science somewhat more ambitious and generous than that at Dachau under the Nazis, where they froze prisoners by immersing them in ice-cold water and then tried different ways of reviving them. But only in order to kill them again and again.⁹ Ettinger’s freezer dream assumed that this world of consumer abundance topped heaven. It was inconceivable that anyone would not wish to extend the allotted time in this air-conditioned commodity paradise.

ICY PARIS: FROM THE 1950S TO THE 1960S

It was just such life-extending ambition that invited caustic flaming from the post-war avant-gardists *par excellence*, the Situationists. In the founding document of the Situationist International, ‘Report on the Construction of Situations and on the International Situationist Tendency’s Conditions of Organization and Action’, of June 1957, Guy Debord wrote of how only their procedures of enabling ‘life’ instead of ‘survival’ could produce something akin to living. His reference point was contemporary medicine and efforts to prolong life.

The most general goal must be to expand the non-mediocre part of life, to reduce the empty moments of life as much as possible. One

could thus speak of our enterprise as a project of quantitatively increasing human life, an enterprise more serious than the biological methods currently being investigated, and one that automatically implies a qualitative increase whose developments are unpredictable.¹⁰

For the Situationists, medical projects for life extension extend only the boredom and misery of this life, which stretches into infinity, making it, in effect, a living death. Bourgeois democracy and bureaucratic capitalism had chilled human beings, turning life into a quest for survival in petrified conditions. It was on this permafrost ground that a new avant-garde emerged and named itself the Situationist International. The Allies might have won the last hot war, but not everyone in the victorious lands was prepared to accept the peace. If Situationist polemic chills the blood – on 14 February 1968, Pierre Henri Simon in *Le Monde* wrote of Debord's 'icy' tune – it is because the very air the polemicist breathes is chilly. Frosty social arrangements, history that is frozen, these are themes of Guy Debord's *Society of the Spectacle* (1967): "Frozen societies" [*Les "sociétés froides"*] are those which slowed down their historical activity to the limit and maintained in constant equilibrium their opposition to the natural and human environment as well as their internal oppositions.¹¹ This description begins Debord's condensed history of time. The frozen societies are early pre-bourgeois societies. The birth of political power, notes Debord, in Thesis 131, appears to be related to the emergence of technologies. He selects iron smelting. It is as if this harnessing of fire for production melts some of the crystallized relations, for it is then when kinship ties dissolve. Industrial and scientific advance warms up the world and gets things flowing, but the dissolution of ties, observes Debord, allows for the advent of 'irreversible time'. This replaces cyclical time based on nature with the time of the ruling class, measured in dynasties and recorded in official documents. Debord cites Novalis: 'Writings are the thoughts of the State; archives are its memory'. An official literary resource develops, and this feeds into the ruling class's efforts at domination. The masses remain trapped in cyclical time, for it is the time of peasant production, and the rulers promote cyclical time mythically as a form of ideological control. Later, after the Middle Ages, the masses break into historical life, but, with the rise of capitalism, cyclical time cedes to another type of time, 'labour time' and the 'time of things' in mass commodity production.¹² With the development of capitalism, irreversible time is unified *on a world scale* as the time of the world market.¹³ Ahistoricity and efforts at equilibrium and retarding change, which are characteristic of pre-bourgeois time, are repeated in the 'pseudo-cyclical time' of the spectacle, which 'retards concrete daily life' and relies on the 'natural remains of cyclical time', day, night, work and weekend, annual holidays, festivals, seasonal fashions, as blocks of time for which appropriate consumables are devised.¹⁴ The freezing returns, even redoubled. The capitalist regime of time is 'spectacular time' and it denies any 'restless becoming'

(Hegel), turning time spatial in a 'visible freezing of life' ('glaciation visible de la vie').¹⁵ Through television, the archive becomes spectacle and crushes out all human life. The vast apparatus for image-diffusion broadcasts pseudo-events in the place of humans living through live events. 'Because history itself haunts modern society like a spectre, pseudo-histories are constructed at every level of consumption of life in order to preserve the threatened equilibrium of present frozen time [*l'actuel temps gelé*].'¹⁶

To freeze is to preserve something from decay, from decomposition, but not to reverse it back into life, the future promise of cryogenics. The freeze signals not just a lifeworld created by a ruling class to maintain equilibrium, but also something adopted by intellectual commentators. The freezing has spread to all parts of the system. Debord attacks the Structuralists for their rendition of the world as static, lifeless, composed of frozen moments: 'The assertion of the definitive stability of a short period of frozen historical time [*période de gel du temps historique*] is the undeniable basis, proclaimed consciously and unconsciously, of the present tendency toward a structuralist systematization.'¹⁷ Such coldness induces the conservation of energy in slumber: 'The spectacle is the nightmare of imprisoned modern society which ultimately expresses nothing more than its desire to sleep. The spectacle is the guardian of sleep.'¹⁸

Raoul Vaneigem alluded to De Chirico's eerie canvases as apt images of this unlied and frozen life:

The blank faces of Chirico's figures are the perfect indictment of inhumanity. His deserted squares and petrified backgrounds display man dehumanized by the things he has made, things which, frozen in an urban space crystallizing the oppressive power of ideologies, rob him of his substance and suck his blood.¹⁹

For Vaneigem the rigid character armour of bodies, an analysis borrowed from Wilhelm Reich, had to be cracked open to liberate the life coiled inside. The armoured bodies of the police and army were the undead. Real life was elsewhere. The Situationist avant-garde movement puts its emphasis on movement, on passing through time again, going with the flow, water not ice. Structures dissolve. Making petrified conditions dance in 'the restless becoming of the passage of time' involved defrosting, decongealing now exhausted avant-garde practice, once critical, now frozen (*figées*) into respectable truths that are now lies.²⁰ It meant defrosting the immobilized spectacle of non-history, crushing the totalitarian vision, the ideological figuring of pseudo-knowledge in the guise of a frozen *totality* (*tout figé*).²¹ In Theses 205 and 208 of *Society of the Spectacle*, Debord puts the emphasis on fluidity: 'rediscovered *fluidity*', 'the fluid language of anti-ideology'. Ideology is frozen and rigid. It freezes language into lies. Words carry the hard chill with them. 'We live within language as within polluted air', observes Debord

in 'All The King's Men' in the journal *Internationale Situationniste*, volume VIII of January 1963: 'Words work on behalf of the dominant organization of life'. But, he notes, too, something remains in words that is strange and foreign. Words 'embody forces that can upset the most careful calculations'. Things, language, ideology, hardened social relations, could be brought into movement again by Situationist practices such as *détournement*. In 'Captive Words: Preface to a Situationist Dictionary', in March 1966 (*Internationale Situationniste*, 10), Mustapha Khayati points to the dialectical nature of language and argues that new meanings could be rattled from the old meanings of words:

Every revolutionary theory has had to invent its own terms, to destroy the dominant sense of other terms and establish new meanings in the 'world of meanings' corresponding to the new embryonic reality needing to be liberated from the dominant trash heap.

Through poetics, reclamation, re-spinning, de-frosting, words could target the chill at their own core and melt the contours of alienated life in a 'revolutionary liquidation of capitalism'.²²

It is unsurprising, given this metaphorical cluster of iciness, that when the system did enter meltdown, the refrigerator would play an eminently dialectical role. In 1965, in the Los Angeles Watts Riots, the 'souls on ice'²³ raised 'the problems of *life*; what they are really demanding is not to survive but to *live*', as the *SI* put it in the pamphlet 'Decline and Fall of the Spectacle-Commodity Economy'.²⁴ This is not a case of medical science's efforts to extend a living death, but beginning to live, to come into being. And this demand emerges through an engagement with the freezer society, an excursion in the frigid air in the heat of the moment. Looting fridges becomes the desired-for act that exposes the deformity of the frozen world. Looting pursues the logic of the commodity lie: America is free, its American-dreamt commodities are for all. But in its realization through theft, the commodity law is denied, exchange-value trashed and even use-value is put into question:

The flames of Watts *consummated* the system of consumption. The theft of large refrigerators by people with no electricity, or with their electricity cut off, is the best image of the lie of affluence transformed into a truth *in play*. Once it is no longer bought, the commodity lies open to criticism and alteration, whatever particular form it may take. Only when it is paid for with money is it respected as an admirable fetish, as a symbol of status within the world of survival.

Such direct action expels the article from fetishism. It returns the commodity as symbol back to use, and then pushes it further in a negation of

usage, in order to install it in the realm of play, which is the realm of life. It countered what the English Section of the Situationist International (Tim Clark, Christopher Gray, Charles Radcliffe and Donald Nicholson-Smith) termed in October 1967 a life under 'the aegis of the cyberneticians', which, if achieved, would condemn man 'to a New Ice Age'. Capital's technological utopia is much too cold to inhabit, like air-conditioning on overdrive. (It should be noted, however, that Debord insists that the Watts Riots were the first to be caused by a lack of air-conditioning.) Wrestling back for revolutionary practice the utopianism of 1960s future shock, the English Situationists note:

A recent 'Commission on the Year 2000' is already gleefully discussing the possibilities of 'programmed dreams and human liberation for medical purposes' [*Newsweek*, 16 October 1967]. If, on the contrary, these 'means of conditioning' are seized by the revolutionary masses, then creativity will have found its real tools: the possibilities of everyone freely shaping their own experience will become literally demiurgic. From now on, Utopia is not only an eminently practical project, it is a vitally necessary one.²⁵

AURA AFTER AURA: LAST BREATHS OF ADORNO AND BENJAMIN

Adorno, in *Negative Dialectics*, of 1966, riffed on images of frigidity, conceiving a chilled world in which 'administered life' and 'frozen identity' are lived as under a spell.²⁶ Here the computer (*Registriermaschine*) provides the principle for thought itself to emulate, 'and to whose greater glory it would like nothing better than to switch itself off'.²⁷ In this bloodless world, coldness is 'the basic principle of bourgeois subjectivity, without which there could have been no Auschwitz'.²⁸ That hell-fire is produced by an earthly principle of universal human coldness, says Adorno. And Adorno found himself confronted still in the post-war by the type whom Walter Benjamin had fixed in 1934 as a 'reduced' person, a person kept 'chilled in a chilly environment'.²⁹ That Adorno still lived, instead of taking the place reserved for him in the camps, made him feel guilty and sent the cryonic dream into its opposite: a nightmare of staying alive and suffering. Adorno writes of himself:

In retaliation, he is haunted by dreams in which he no longer lives, but was gassed in 1944, and his whole subsequent existence has been led purely in his memory, emanation of the crazy wish of someone who was killed twenty years ago.³⁰

Life becomes the wish, death the reality. The deadly life is lived as under a spell, a curse, indeed. The spell is uttered by technological, mechanized

rationality. Perhaps this spell is the spell that keeps Snow White in her glass coffin, just like Disney. This is the enchantress sunk in not-life-not-death, awaiting the kiss of power, or, in the Grimm brothers' version, the dislodging of the chunk of poisonous apple that had lodged in the throat, 'so that she opened her eyes, raised the lid of the coffin, and sat up, alive once more'.³¹ The spell is capital's promise of a marvellous future, just never yet. Adorno's hope does not lie with the English Situationists' confidence in techno-future, seized rather than awaited. Adorno nestles in dystopia, and hopes for even more decomposition, for it may break the hex. In this cold place, the spell is 'coldness between people', and this principle asserts itself, for to counter it is to be marked out, 'to feel condemned': 'Under the spell, everything that is different, and of which indeed the smallest trace would be incompatible, transforms itself into a poisonous substance.'³²

This poison escapes the law of identity. There is a hope. Perhaps this poison, this enforced negativity, could kill death itself. In a freeze-dried world, the virus is kept on ice, waiting to find a host. The poison is that moment of total critique, venomous, offensive, not to be eliminated by techno-science in the germ-free world of the future where all disease is curable, where the breath of life is always fresh because masked by mouthwash. Adorno wants breath, in the form of aura. He hopes to hold onto aura in the post-war. Aura is the good magic, the spell that works. Aura marks the distance between art and life. It is a register of how far there might yet be to go. For Adorno distance is the phenomena in artworks that transcends their mere existence, were they absolutely close they would be absolutely integrated.³³ However, he notes that Benjamin's construction of aura in his essay 'A Short History of Photography' is a more dialectical, true version.³⁴ This definition takes the reader into a constellation of the social and the natural, of inspiration and expiration. In the essay on photography's history, Benjamin constitutes aura as a physical-natural experience, and such experience is conceived not primarily optically but tactically, *taktisch*, of the body, essentially. Aura – the experience of distance – is an experience apparently to be had while in nature, in the landscape. Benjamin writes of aura and photography in 1931:

What is aura, actually? A strange weave of space and time: the unique appearance or semblance of distance, no matter how close it may be. While at rest on a summer's noon, to trace a range of mountains on the horizon, or a branch that throws its shadow on the observer, until the moment or the hour becomes part of their appearance – this is what it means to breathe the aura of those mountains, that branch.³⁵

Here aura (as breath) is a component of a physiological process, essential to human life (if also increasingly redundant – or forced into crisis – for art in a technological age).³⁶ The 'breathing in of aura', this exchange of air and

body, relates to mimetic thought in Benjamin, producing, thereby, a holistic vision of a universe, exchanging energies, in contact at all its points. The universe is dialectical, reciprocal and in tension at once. The natural experience of aura becomes increasingly a social experience that either excludes aura, or reweaves it according to a false pattern. Technology had generated a sort of aura before, according to Benjamin, on the battlefields of the Great War where chemical gases fuzzed up the European landscape, expelling through toxic, heavy air the possibility of contemplation at peace. Later, in the epilogue of his 1930s essay on the artwork in the age of its technical reproducibility, Benjamin announces that the gas warfare of the First World War abolishes the death of aura anew. It destroys the vista of nature as a place of contemplation. In altering the rules of war and hazing up the battlefield something akin to aura, a haze, is reproduced, but its qualities are quite different: this is aura after aura. It takes its place alongside those other entities that generate not aura but fake aura, the rotten shimmer of the commodity fetish or untimely artwork. At the end of auratic experience, in modernity's new denaturing, is aura's technological reinvention as synthetic. The aura of nature does not vanish. Auratic experience remains experience of a peculiar weave of space and time, the experience of distance, and yet, undeniably, natural experience is also technological, industrialized. Aura, the air, the cool breeze on a summer's day, turns toxic, is polluted. We cannot escape it, for it surrounds us and is our world. Aura after aura is a difficult formation. It is investigated in the poetry of J. H. Prynne.³⁷

COOL BRITANNIA: ENGLAND FROM THE 1960S TO THE 1970S

Prynne's 'Cool as a Mountain Stream' (from a collection of 1974 titled *Wound Response*) addresses the commercialization and industrialization of natural auratic experience. The poem opens with an echo of Walter Benjamin's description of auratic experience in the summer afternoon, tracing the line of a distant mountain or a twig. But soon decay is noted, a body in decline, consuming itself, within a world of global choice 'all over the earth'. This is nature run rampant, auto-destructive:

The apple cap sinks down to your faint hopes,
 sprawled in the sun on the grassy hillside,
 shirt over the soft
 haemal arch. By this vane in the ground
 the roots start to sicken,
 snow normal to zulu time stuns soft news
 of choice all over the earth.
 You spin with erotic doubt, ah then,
 hysteric tenderness, is this

the mount of our youth
or his body? He must
be eaten slowly, by autolysis of face
thus forced to riot, claimed
by soft hands in his shirt: not a beast of virtue.

Water rots in the stem. The park is called in.
We will come now. We do
pump & burn with hormone of the forest,
soft hair mute against
what we say. So the shirt thickens with salt:
breathe against it and hear
what you are,
'vigorous and moderately upright',
that noise again, 'soft juicy flesh';
pollen here is bright feeling, damp spores
stamped down in the Eckman spiral of stripped earth.
Now a haploid cyclone of insect lust
throws the heart into spasm & hard rock,
whirling round in the shirt
where the wound smiles
like a well-stocked
three-star freezer. 'Perfect
conservation' / slow rot in the fibrils, the sun
mounts in greed and its soft fingers.

The toothsome wound, the hurt that smiles, conjures the iced delights of the future promise of consumption. Our injury manifests itself alluringly in frozen foodstuffs, with freezing an effort to deny natural process. The smiling hurt suggests that we embrace our pain, as we embrace the cold delights of refrigeration and the consumer society. We clasp our arms around the coldness. Seeming perfect conservation is but the elongation of decay, the thin threads of muscle rotting. Perfect preservation is impossible, for that would deny the workings of history and nature, allowing only stasis. Against stasis, and a separation signalled by silence, this poem references the warmth of sexual contact and the heat of the sun counteracting the frost. But this is seemingly as necessity, not choice. Haploid single sets of unpaired chromosomes are seeking their opposites, not human though, but insect. Even more primitive is the sexual 'pump & burn' of the hormonal forest, and 'soft juicy flesh' that might be human, animal, or might be fruit, the effect of wind on ocean currents, the Eckman spiral, a transaction between matter and matter. And everything in this poem seems to pull human-ness down to something before the moment of walking upright and being civilized: 'vigorous and moderately upright', but not fully; a heart in spasm not love; deposits of

spores, mere life of insects; unconsciousness of hard rock, the exuding of salt, of minerals from our bodies, our sweat betraying our relationship to rock.

The tumble of words in this poem catalyses connections, which are impossible to prove or logically to reconstruct (indeed noted here is the very failure of language, 'that noise again', to express the body, 'soft hair mute against what we say'). But its fizz of science and emotion articulates something that coincides with and runs parallel to contemporary experience. The title of Prynne's poem, 'Cool as a Mountain Stream', is an advertising slogan. It served to sell Consulate menthol-flavoured cigarettes, the very stuff of cool breath, its 'spring freshness' a saleable fantasy of icy minty air passing through the lungs (was this the same poisoned air that led to Disney's premature demise?). Inhalation – of air, of tobacco smoke, of medicines – when oxygen or other gases pass across the cell walls of the lungs and mix with the blood. Inhalation, this word contains that word halo, a word for breath and aura. Prynne's poem speculates on consumption, in two senses, as buying (for the well-stocked freezer) and ingesting, that is the breathing in of this polluted air. The commodity stamps itself over natural experience. Consumption in its doubled sense is the switching point between the social and the natural worlds. In the collapsing structure of this poem, it seems that the experience of aura is the experience of the commodity. This says no more than Marx said when he wrote of commodity fetishism and its misty enchantment of wares. Inside this system, breath, the action of life, sucks in pollution, life's choker. The pollution is sweetened, masked by a signifier of freshness, toothpaste's favoured minty-ness. Decay pervades the poem. The freezer's 'perfect conservation' cannot prevent the slow-motion rotting towards death. It is a rotten world, and conservation of it is the extension of the slowed-down decay. Elsewhere the sun's heat putrefies the fibres, dissolving the hardness of arrangements. The autolytic overactive wound, tissues or cells disintegrating by the action of their own enzymes, might 'force to riot'. Natural processes assault commodity form, as they assault the material body of the commodity, and they self-destruct, turning in on themselves. All through *Wound Response* are images of vulnerability, wounding, metabolic exchange, treatment through blood analysis and the administering of drugs. These line fragments attest to the themes of physiological crisis: 'thus he / jabs a hysteric wound' ('Treatment in the Field'), 'bronchial collapse', 'I struggle with cautery' ('The Blade Given Back'), 'So the tenant comes back under his arch / of blood, affirming its pulse; the air dips / sharply and we are cold in / wide-angle blankness, / by a bridge on the motorway not yet / open to traffic' ('Pigment Dépôt'), 'The warmth of cognition not yet neuroleptic but starry and granular' ('Of Movement Towards a Natural Place'), 'xylocaine snows / him under the table', ' . . . to make a lozenge, / to oil the throat of the frozen / fish dinner' ('An Evening Walk'), 'Air to blood / are the two signs', 'Shouting and / laughing and intense felicity given over, rises / under the hill as *tinnitus aurium*', 'fear / grips the optic muscle. Damage

makes perfect', 'reduced cerebral blood flow and oxygen utilization / are manifested by an increase in slow frequency waves, / a decrease in alpha-wave activity, an increase in / beta-waves, the appearance of paroxysmal potentials' ('Again in the Black Cloud'). These words do not signal an ecstatic interaction with nature, but nature subjected to toxicity: material passes in and out of the wounds on the body. It is a switching station of long-term geological processes, contemporary scientific investigation, commodity innovation and marketing, consumer fads. These figure distortedly but obviously in Prynne's linguistic alchemy, as in 'Royal Fern' from *Brass* of 1971. Here are stanzas 4 and 5:

4

Still the snow hums, fetching my life:
the pain to come, still the key
takes cover in the chamois case.
The key is the edge of our day.

5

So the fiat parks by the kerb.
We hear him switch off, he is
dreaming of the void. In time,
soup for the father in open green.

The chamois leather of the alpine deer has come down to our basal level. It is the little square of soft leather with which a million proud car owners polished their vehicle on their 'free' Sunday mornings. It has been domesticated. But in this snowy drift, there may be hope. The royal fern of the title is a plant whose structural elements link to the Permian period, before the Great Ice Age, and so it survived under ice-age snow.³⁸ It was almost made extinct in the Victorian period when collectors gathered samples for fern cabinets. But it survived a second time. There is a hope that the frozen might yet come back to life again and the snow of the now that seeds a sleep might yet be preservative, suspending animation until a warmer climate comes: 'It *may* all flow again', advises 'The Wound, Day and Night' (*The White Stones*, 1969).

Prynne's *Kitchen Poems*, of 1968, drank in the turbulent froth of 1960s political economy and consumer society. The lengthy poem 'Die A Millionaire' (pronounced, we are told, 'diamonds in the air'), spoke of consumer wants and social needs. Its references set the nomadic drift which is 'genuine expansion' against the purchase 'of a natural course', meaning the Suez Canal, a feat of imperialism, an acquisition.

... what starts as irrigation ends up
selling the megawattage across the grid.

The current turns to currency. This flow lines pockets. There is a grid of ownership and commodities that have us in their grip, as we, 'unthinkingly hungry', eat rubbish.

And don't let some
wise and quick-faced historical rat tell us about
the industrial north and its misery, since every
songbird since then (& with *no* honourable
exception for D. H. Lawrence) has carolled about
that beautiful black colour as if
this were the great rot in the heart.

It was not and it is not. The twist-point
of this is again power by the grid, putting
lives into strings of consequence into
molecular chains like the pit-ponies we love
to cry over. Coal is so beautiful as I
could weep over the carbon it shines with:
what is scattered over those colliery towns
is not soot or sulphur or coal or foaming
detergent but the waste produced by
mass-conversion of *want* (sectional) into
need (social & then total). All this by
purchase on the twist-point, the system gone
social to disguise

the greed of ambition
swimming in great seismic shocks through
the beds of our condition.

We are the 'social strand' that has gone too far, already 'past the twist-point & / into the furnace'. But we don't burn, 'because / we are invisible to each other.'

But in the end how could such poetics allow its readers to make sense, to turn it back into statements and logical threads? The poems are, like many, but much more than some, about language itself. This is an avant-garde with the emphasis on garde, guarding, warding language. Set in these poems, words rattle through all the possible and impossible layers of meaning that they might possess. They return to a fullness of meaning, which exists elsewhere than instrumentality or cliché. Language is a means into discourses and disciplines. The specialist language of scientific research smashes against the language of lyric or clichés. We find out how separated and divided up is our knowledge of the world. The compartments of knowledge have solidified. This writing bares the partitions. The words of power, science, domination are détourned, set to clash with themselves and each other in poetry. In

these new contexts meanings run fluid, so fluid they cannot be quite grasped. This then is a preservation of words in deep cold storage, waiting for language to find the cure to its own decomposition. It is a cryonic suspension of lyric. Snow, ice, the chill makes its appearance frequently in Prynne's collection of 1969 called *The White Stones*, where ice, snow, tundra, glacier are recurrently imagined. It is in this uninhabitable setting that lyric poetry aspires to find a place of temporary shelter, but sceptically, after aura. For if aura exists after aura, it must be a mixed gas, a polluted air, an artificial respiration.

The public hope is as
 always the
 darkened ward
 the icecap will
 never melt
again why
should it

(An excerpt from 'If There is a Stationmaster at Stamford sD. Hardly So', in *The White Stones*, 1969.)

The scale of time here is geological, but humans, breathing beings, reside hopefully in their moment, affecting, changing, exchanging. Capital's technoutopia is cold and ever-colder, and so are we, and we cannot escape it, but it is in contradiction with itself and, therefore, with us. Perhaps the warming, the apocalyptic global warming, will save us.

In 1968 Prynne wrote a prose piece called 'A Note on Metal'.³⁹ It echoed aspects of the theory of matter and power voiced by Debord a year earlier. The early Bronze Age is identified as the beginning of Western alchemy. The emergence of metal technologies offered a type of magic processing of forms through smelting and beating, and later alloying. Before metal, weight was matter's crucial property, exemplified in stony solidity, from which qualities could be rested only by exertion. Copper, tin, antimony possess not only weight but also 'brightness, hardness, ductility and a general ease of working'. New qualities can be gained by working with fire, by technique. Sharper, more deathly qualities can be teased from metal than from flint or wood. Metal ploughshares carved up the land more deeply and with less effort. Stone, a 'history of substance', cedes to metal, a 'theory of power' (though stone remains a marker of a more human passage through time, as the headstone at a grave testifies). From metallurgy develops mining and the importance of place, of digging into the earth and settling. The extraction of substance leads to the abstraction of substance in a money economy, and the weight of the ingot gives way to the number of coins. Gold, and mixed-metal coin, is not an adornment of power but a value measurable against other things in trade. Value is the new principle of organization and the 'theoretic properties of metal are further displaced into the stratified functionalism of

a monetary system' in bimetallic currency. Weight is virtually defeated, and substance holds out only as a utopian dream in exile. Metal is abstracted into coin, and as coin it perpetuates further abstraction, mediating social relationships and snaring all in an orbit of exchange.

Metallic value made its way into Prynne's poetic output. The cover of *High Pink on Chrome* of 1975 was metallic pink card, with the title in sober black type, righting the diagonal effrontery of *Blast*. Prynne's booklet looked like the metallic covered volumes of *Internationale Situationniste*. The first, in June 1958, was bright gold and the last, in September 1969, was lilac. In between there was a rainbow of shades of Chromolux metallic paper, and the title appeared always in sober black type. These pamphlets, like Prynne's, caught the light and dazzled the beholder. Ralph Rumney, who had been painting with gold leaf, claimed credit for this design.⁴⁰ Christopher Gray noted that its purpose was to stop it getting sodden in the rain.⁴¹ Be that as it may, the cover's sheen gleamed like a bauble and out-glossed spectacular society. The metallic covers were attractive, even fetishistic, but their perfect sheen betrayed nothing of what was inside: venomous rhetoric and denunciations of commodity society as well as ridiculing critique of the Left. The covers were like a colourful, lustrous sugar-coating on a poison pill. Prynne's title, *High Pink on Chrome*, reiterated the Chromolux material of the cover, as much as it evoked a blushing, bleeding human encounter with the metallic world. This too had toxicity in mind. Of Prynne's sleek sheath, Ian Patterson notes that

the lurid sheen of the book announces a danger: metal is now not only a metonymic symbol of value, it is a circumambient and toxic presence in the foodchain, with consequent requirements to redefine the pastoral. What the eye doesn't see, the liver dies of. Agribusiness has transformed the landscape in a more potent and pervasive way than the clearances or enclosures ever succeeded in doing.⁴²

The cover engaged in wordplay for chrome comes from the Greek word for colour, and the metal chromium was originally called chrome, because of the colours of the compounds that it made. Chrome is, then, both metal and colour. Inside, among the words reduced to a dark blue that appears at first glance black, is the line: 'The green / is lost or painted up with fear'. As colour drains, all that is left is the toxic rest. The words inside the covers caught glints of metal invading the body, and suggestions of nature's own products turned against nature. The lines tumble: 'He farms the pelt with aniline', 'The halter of melon seeds, dyed / in the grain', 'Thus there is no doubt that some of the toxic effects of these metals is the result of a cell-mediated immunological reaction against the body's own proteins modified antigenically by the metal and that this is some way genetically controlled', 'It seeps under the nail, what ought / to be known', 'The toxic action is severe adrenal trauma, / corroding by touch,

leaving / a blackened scar', 'the air corrodes his throat and / nails him twitching to the Earth'. A blackened scar, the dark twist of words condenses all the toxicity of the epoch and the negativity of the poet's stance towards it. This echoed Adorno's stance on aesthetics, conceived in his unfinished work *Aesthetic Theory*.⁴³ For Adorno, the only justifiable colour was black.

In order to exist within the extremity and darkness of reality, artworks that do not wish to be sold as comfort must make themselves the same. Today radical art means dark art and its background colour is black. Much contemporary art disqualifies itself by taking no note of this and instead childishly delighting in colours.⁴⁴

Art's utopia, 'the counter-factual yet-to-come', is draped in black.⁴⁵ Darkness marks the place where possibility holds out against actuality. Black works against the deceitful sensuality of culture's façade. Adorno's insistence on black reacted to what seemed a world of ever-louder colours. In 1959 he observed colour's high-pitched shriek in 'all too much more intense and conspicuous colours'. These new colours turned book jackets into advertisements for themselves, in efforts to shake off all that is bookish, old-fashioned and retrogressive about the book.⁴⁶ Parodic sheen was too able to be misunderstood. Colour may be life's colourful reflections, but it was also a mechanism for drawing attention to the commodity heaven of the post-war. These new commodity colours were synthetic, and the synthetic came to be a testament to the new improved temper of life itself.

CRAZY COLOUR: A BRIEF HISTORY OF FLUORESCENCE

In his youthful writings, Walter Benjamin wrote a Romantic dialogue on the colours of fantasy, colours that existed only in the imagination.⁴⁷ These are pure colours, to which children and artists and dreamers alone are sensitive. These fantastical colours are only dreamt up, not cooked up in laboratories. Benjamin's essay hints at the sense in which all colour is only dreamt, or at least, in a way, simply in the mind, an effect of the brain's interpretation of light frequencies. Colour needs eyes to be seen, and eyes make colour. Our eyes possess photosensitive receptors. One set is sensitive to red wavelengths of light, a second is receptive to green wavelengths, the third to blue-violet wavelengths. These receptors sense vibrations and operate using the principle of resonance. Our eyes tuned to the three frequencies of red, green and blue light make from their combination all colours. There is more than just a simply objective process at work in the perception of colour. Colour is, depending on your perspective, both absolute and conditional. Available light, eyes and brain all contribute. The Romantics could imagine colours unseen, the hues of poetry and fantasy, subjective colours, invented by the eye and the mind, but what they could not yet know are the colours of the future, the

colours that would come to light under a light not yet harnessed. These are the twentieth century's colours cooked up in the laboratory, colours of energy and excess, the brilliant colours of hallucination made tangible.

A slip and a bonk on the head while unloading crates of food from rail-cars for the Safeway grocery store chain had put one of the Switzer boys in a coma, interrupting his studies at the College of Chemistry in Berkeley. When he woke again some months later, vision blurred and permanently damaged, he was confined to a darkened room. This absence of light led to a fascination with ultra-violet light. He played around with ultra-violet light in his father's drug store and found that some chemicals glowed in this strange dark non-darkness. And so, with his brother Joseph, Robert started searching for naturally fluorescent organic compounds. They experimented in the family bathtub with dyes and resins and fluorescent preparations, making colours that were brighter than normal and glowed under UV rays. These experiments in the 1930s led to the first fluorescent paint. They used this new fluorescent colour in their little magic shows. The Switzer boys' magical play with chemicals was not unusual. Chemistry sets were popular toys after the First World War. A. C. Gilbert had begun with boxed magic sets in 1909 and produced a chemistry set in 1917. Porter started his business in 1914 with two 'chemical magic' sets, and by the early 1920s six different sizes were on offer. By the 1930s it was possible to obtain 'atomic energy sets'. In the Chemcraft, which was Porter's junior chemistry outfit, the manual with its 'fifty demonstrations of chemical mysteries', opened with instructions for staging a 'chemical magic' show for friends and family, including publicity, costumes and suggestions for sound effects.⁴⁸ The Switzer boys staged such a show. Their experiments yielded a fluorescent paint, which they applied to a mask and head-dress, creating for an audience in a darkened auditorium the illusion that a dancer moved one way while her head floated off in a different direction.

The new fluorescent colours were eye-catching. They leapt out to the eye more than other colours. These were colours keen to assert themselves. It was as if a new part of the spectrum had been discovered. Colour arises in ordinary objects through selective absorption. Something that is green absorbs all colours, except green. A cherry reflects back only red, emitted at the same wavelength as that absorbed. Ordinary paint absorbs some of the spectrum from white light and reflects the rest. It absorbs and reflects light from the visible part of the spectrum. Fluorescent paints do not simply scatter light back from the visible part of the spectrum. They can also soak up shorter wavelengths (such as ultra-violet), which are invisible to our eyes. They re-emit the energy by transforming it into photons of longer wavelength. The energy in ultra-violet light is converted into visible light emitted by the chemicals in the paint. Fluorescent pigments absorb photons and the high-frequency ultra-violet radiation excites electrons into a higher energy vibrational state. Agitated, these send off waves and a glow is seen. This is what produces their extraordinary brightness. Fluorescent paint lets more of itself as colour be

seen; it shines brighter. It seems as if it holds within itself a source of illumination. Fluorescence buzzes in ordinary light, but it positively fizzes under other light types, such as blue light, short-wave ultra-violet light, long-wave ultra-violet and x-rays. Fluorescent colours are up to three times brighter than conventional colours. They shine more brilliantly, more vibrantly.

In 1934 the family kitchen became home to The Switzer Brothers Ultra Violet Laboratories. In 1936 a firm in Cleveland, Ohio, engaged the young men to produce dyes for movie posters for Hollywood, but the firm came to think that fluorescent colours had no future and let them go. War came and their new colours found military application in bright signal panels used by troops in North Africa to identify themselves as friendly to Allied dive bombers. Fluorescent paint also enabled pilots to land warplanes at night on aircraft carriers in the Pacific, an advantage not possessed by the Japanese. The Switzer brothers developed fluorescent inks that bombardiers used during blackouts and fluorescent penetrants to find hidden flaws in machined parts, such as engine pistons and rockets' liquid oxygen tanks. Fluorescence could help win wars. The Nazis knew that too. They developed similar materials, so they could have luminous runways in aerodromes and see-in-the-dark dugout entrances, luminous cement, house paths and kerbs.⁴⁹ They tried out a radiolitic paint, made from oyster or other sea shells, chemically cleaned, and then heated over a hot fire. Once cooled the shells were ground into a fine powder, all grey particles removed and the rest placed in a crucible in alternate layers with flowers of sulphate, hermetically sealed, and subjected to intense heat. This mixed with gum water or shellac produced a luminous paint, whose iridescent effect was renewed daily by exposure to natural light. This was painted onto vehicles to allow Nazi eyes to penetrate the darkness. With such extraordinary luminosity war could be executed by day and night.

In peacetime, fluorescent colours found new civilian uses in safety signage, on billboards and promotional publicity. In 1946 the Switzers' firm was incorporated as Switzer Bros. Inc. They trademarked their dyes as Day-Glo. The firm grew and a third brother joined in the business in the mid-1950s. Day-Glo colours were in demand and its luminescence found many uses. There were other chemists of luminescence investigating colours never made before. Marcel Vogel was a phosphor chemist whose interest had been stimulated as a child by glowing fireflies in his Californian backyard and the German-language body of research into luminescence available at the Mechanics Institute and the university library. From 1944 to 1957 his company, Vogel Luminescence Corporation, founded in the 1940s, produced fluorescent bulletin paints for billboards, artists' materials such as fluorescent oil colours, crayons and chalk, phosphorescent paints, invisible ink, as well as ultra-violet kits for detecting insects, cancer, and milk quality, and the red hue used in colour television sets.⁵⁰

The North American post-war landscape zinged with brighter than bright colours, many of which were now in the service of advertising. In

1947 Canadians saw the first Day-Glo colours on a billboard. Chesterfield cigarettes used fluorescent colours on packaging. In 1959 fluorescent colours appeared on a soap-powder box. Proctor and Gamble made their first box of Tide in shrieking colours. It should seem to leap off the supermarket shelf into the shopper's basket. In the years after the war brightness was brighter than ever, and what was inside the packet mirrored the luminescent packaging outside. In the late 1920s and early 1930s German chemists first worked on the science of optical bleaching agents. From the late 1940s clothes were laundered in detergents to which 'optical brighteners' had been added. These invisible dyes fluoresced under ultra-violet light and made products appear 'whiter than white' under normal daylight, the ultra-violet rays beaming back as visible radiations of light. The whiter than white quests of science found a moral analogue in the German chemical industry's attempt to exonerate itself from Nazi misdemeanours. Authors commissioned for major firms wrote cleaned-up company histories and publicists asserted the continuing necessity of chemistry for a good and healthy life. Even the product Zyklon B could be presented as a good delouser that had simply found its way into the wrong hands. In 1947 Henkel, a company based in the British occupation zone whose flagship product was Persil soap powder, wanted to protect the company's integrity under threat of dismemberment. It had been accused of producing rocket propellants and providing glycerine for the production of bombs. The company issued 'Tod Durch Dreck', 'Death Through Dirt', a pamphlet that warned of the hygiene disaster to come should Henkel be dismantled. When compensation for slave labourers or the dispossessed was squeezed from the companies, it was furnished as a gesture of goodwill and generosity, and not as amends for war crimes.

Chemistry promised much in the post-war period, and much of what it promised was a better life lived synthetically. Germans dressed in the new synthetic textiles. Between 1953 and 1959 plastics production more than tripled in the Federal Republic of Germany. In 1951, once IG Farben was dissolved and the traditional firms such as Bayer were refounded with German businessmen at their helm, production resumed.⁵¹ Much in demand were dyes and treatment agent for synthetic threads in order to colour polyester and other synthetic threads. The plastic Makrolon was also a great success. By 1962 Bayer had more than 60,000 workers pumping out synthetics. In the 1950s BASF concentrated on plastics, and in the 1960s it set up production sites in every continent. Companies were bought up and others founded to produce surface coatings, drugs, crop protection agents and fertilizers. Meister, Lucius & Brünig, now called Hoechst, expanded rapidly in the 1950s and '60s. Petrochemistry, plastics, films and synthetic fibres such as Trevira were crucial products.

In the USA plastics moulded the happy-go-lucky American dream with the fluorescently pigmented Hula Hoops, Frisbees and Big Wheels of the

American family 1950s, while US freeways of the 1960s were lined with Blaze Orange traffic cones and safety signage. American women encased themselves in Spandex foundation garments. American youth wore clothes washed in detergents containing phosphates that glowed chemically under ultra-violet rays. Teeth brushed with toothpastes containing monofluorophosphate imported luminescence into the body. Dental enamel shone out in discotheques, making youthful American bodies appear like the radiant skeletons jiving in the blackness of Walt Disney's *Skeleton Dance* of 1929. In Disneyland, it was possible to journey through plasticized artificial landscapes, such as the Alice in Wonderland ride, made of fluorescent scenes illuminated by ultra-violet light. Pleasure glowed in the dark and super-exposed itself by daylight. Day-Glo Color manufacturers insisted that this colour ensured higher impact, increased visibility even in shade, reader attention and message retention. These were the colours that consumers preferred, as 'studies have proved'.⁵²

Commodities had found their perfect finish. Aniline paints and dyes had first been marketed as more valuable because they were more 'real'. This 'real' quality was based on the fact that they did not fade. Plastic likewise was marketed as a substance that was not tarnished by history or nature. Both Roland Barthes and Tupperware would make a virtue of plastic's mutability and flexibility. Plastic's essential oneness could be seen as transcendental. Barthes, in 1957, called it 'the very stuff of alchemy', for, as 'raw, telluric matter', it is shaped automatically and miraculously, into buckets or jewels or anything. Nature is outbid. Euphorically, humans freewheel through it. Barthes also noted plastic's undoing: its lack of substance, its flatness, its chemical colouration, its prosaicness, its lack of pretension.

The hierarchy of substances is abolished: a single one replaces them all: the whole world *can* be plasticized, and even life itself since, we are told, they are beginning to make plastic aortas.⁵³

This was a substance without luxury, an appropriately democratic matter. It was purely for use, purely to be used up, even in the business of pumping blood, of living life itself.

Adorno perceived in the American landscape of lightness, brightness and substitution a kind of madness. Adorno's description of a bookcase in a villa he visited in Maine in 1959 conveyed his terrors in the phoney society. The great titles of literature faced him and he reached out to take one. The whole display collapsed. It was all fake. The world as a simulation of itself is a crazy thought, but a true one too. In Adorno's story there is something else at play. It concerns the death of learning, the death of culture and the victory of the 'culture industry'. But the phoniness is present everywhere. Adorno mentions wily restaurants that sell bottles of 'counterfeit' red wine coated by a layer of synthetic dust.⁵⁴ Time itself is synthesized.

In 1967 Pamela Zoline's story 'The Heat Death of the Universe' visioned the entropic decay present in the seemingly perfect world of convenience consumer products and chemically based substitutes.⁵⁵ A mother considers the properties of a cereal box, its perfect form and its 'squandered wealths of richest colours', its offer of membership of a club upon payment of 50 cents, its cut-out mask, and its cynically placed 'surprise gift', urging the children on to eat their Sugar Frosted Flakes at super-speed. Their mother hears the tooth decay already at work and the 'bony whine of the dentist's drill'. She worries that all the offers and features on the box are an inducement to quick sales before the news of its toxicity breaks. She wipes her yellow-marbled Formica table with a blue synthetic sponge, which matches the colour of her eyes:

A fine, modern, acid, synthetic blue; the shiny cerulean of the skies on postcards sent from lush subtropics, the natives grinning ivory ambivalent grins in their dark faces; the promising, fat, unnatural blue of the heavy-tranquillizer capsule; the cool, mean blue of that fake kitchen sponge; the deepest, most unbelievable azure of the tiled and mossless interiors of California swimming pools.

On the diaper bin she writes in Blushing Pink Nitetime lipstick the phrase: 'The nitrogen cycle is the vital round of organic and inorganic exchange on earth. The sweet breath of the Universe.' The mother recognizes the natural law of the universe, which is a law of life even as it moves towards death. But that does not make the constant struggle against decay any more bearable for her, as a housewife, and so more fully entrapped by the arrays of detergents and deodorants. Onto the synthetics falls the dust, an endless layering, to be removed by the mother, or left there as a sign of her 'madness'. She shops in the supermarket under fluorescent lights, a brighter, colder, cheaper light than daylight. She chooses one of every cleaning product, window cleaner, antiseptics, soap, and one of each size in the product family. This is a synthetic world that is becoming California all over, the state that has perfected fakery and where the sky is 'so filled and bleached with detritus that it loses all colour and silvers like a mirror, reflecting back the fricasseeing earth'. None of this will hold in the long term, as each particle of matter becomes more agitated, 'until the bonds shatter, the glues fail, the deodorants lose their seals'. From so much synthesis will emerge in time the great synthesis of all again into soup, a puddle, the end of the world.

Fluorescent pigments had infiltrated the American landscape as entertainment, as signals in war, as alert to danger and as commodity shriek. They brightened the American dream and made it luminous. The counterculture moved in only later. In 1957 Humphry Osmond coined the word 'psychedelic' to describe the experiences of psychiatric patients. A decade later this name would attach itself to a style epitomized in fluorescent posters. From the 1930s, the us firm DuPont had the slogan 'better things for better living

... through chemistry'. By the end of the 1960s the motto was reproduced on badges and the chemicals referred to were recreational drugs. Switzer Bros Inc. changed its name to Day-Glo Color Corp. in the later 1960s. Day-Glo became a household word through Tom Wolfe's book of 1968 on Ken Kesey and the Pranksters, *The Electric Kool-Aid Acid Test*. In headshops psychedelic freaks bought neon posters that released their cryptic images only under exposure to uv light. The Doors of Perception were flanked by light switches for blacklight bulbs. Day-Glo was tinged with vulgarity, the too-obvious, the screamingly evident 'Buy-Me, Buy-Me!' For some, this over-exposing pigment was just too crude. In its entry on the word Day-Glo, the *Oxford English Dictionary* cites an article in *The Listener* of 19 September 1968, which dismisses as vulgar the use of flashing Day-Glo in the cinematography of Jack Cardiff to signal an orgasm.⁵⁶ Vulgarity, cheapness and commercialism dogged Day-Glo, but its manufacturers' aspirations seemed limitless and sublime. The names given to Day-Glo Color Corp.'s palette of colours ring with the poetry of science, industry and space exploration. The full trademarked pigment set comprises Neon Red, Rocket Red, Fire Orange, Blaze Orange, Arc Yellow, Saturn Yellow, Signal Green, Horizon Blue, Aurora Pink, Corona Magenta. Each one fizzes in its optical attack, saturating vision, soothing and alerting simultaneously. The cosmic utopianism of space travel, as well as the love of the alien-sounding letter x, permeates the product line names: Starfire, Filteray, Vexex, Optex.

Fluorescent colours decorated a world in which space exploration had advanced. Earth had been imaged by rockets in space in 1947, and then, sharper and more spectacularly from the us Navy Viking II rocket in May 1954. And these rockets headed for the moon or launched satellites that were man-made moons. Such developments were helped by the presence of Wernher von Braun and other Germans at the us Military and, from the late 1950s, NASA. Braun's scientific research supported the latest type of entertainment, the theme park. He worked as a scientific consultant to Walt Disney in the mid-1950s, designing, for Tomorrow-Land, with Willi Ley, another scientist from Peenemünde, The Moonliner, a scale model of a '1980s' commercial rocket that would fly tourists to the moon, and which bore a striking resemblance to another rocket he knew well, the v-2.

COLOUR AS RESISTANCE: THE DAY THE WORLD TURNED

DAY-GLO™ IN THE 1970S

A century before Punk emerged as rebel youth subculture, the word itself meant something else. It denoted something worthless, foolish, rubbish, empty talk, nonsense such that Carlyle could speak of 'phosphorescent punk and nothingness'. Punk was something evanescent, blazing intensely for a moment in the dark. When it came to future dreams for colour schemes,

however, punk preferred fluorescence's immediate shock of the glow to phosphorescence's postponed illumination of its self in the darkness. Fluorescence holds nothing back for later. Like 1970s punk, its mode is the mode of anti-interiority, denial of romantic self, a cheap trick, a cheap trip without inner-ness, a slap in the face of public taste. Its colours of choice were Day-Glo. Punk's post-war version of Wyndham Lewis's material desideratum forwarded not the metallic-machinic society but the plastic consumer society. That is to say, it embraced it and repelled it, but always stood firmly inside it. Punk's world was the post-war chemical world of surface coatings and surface imitations, wood-grain patterns, wood-chip paper, and, ultimately, Formica, as the triumph of synthetics as imitation of anything or nothing. The acerbic squeal voiced in *Blast* found an echo 60 years later in Poly Styrene's lyrical rejection of a germ-free adolescence and the post-war plastics that were the engine of a new industrial economy. Poly Styrene, the singer with X-Ray Spex, woke up in a world that was synthetic. The shiny metal and chrome that caught Lewis's eye had paled as the Americana chrome dream flecked, even if it could not tarnish. Plastics were the new flexible friend of global economies – even money was now plastic, since 1951, in the form of credit cards. Poly Styrene sang songs with titles such as 'Plastic Bag', 'Genetic Engineering', 'Germ Free Adolescents' and 'Art-i-Ficial', with lines such as: 'I know I'm artificial / But don't put the blame on me / I was reared with appliances / In a consumer society.' She shrieked the demand: 'I wanna be instamatic / I wanna be a frozen pea / I wannna be dehydrated / In a consumer society.'⁵⁷ Poly Styrene named herself after an IG Farben / Dow Chemicals product from the 1920s, which had been a commodity resin since 1949. The name led to the centre of the matter, for a synthetic styrene had first been prepared in 1869 by Marcellin Bertollet, the scientist credited with championing synthetics. Poly Styrene's lyrics, in 'The Day the World Turned Dayglo', were a chemical retort to the internalized hippy-trip of The Beatles' 'Lucy in the Sky with Diamonds'. She clammers over mounds of polystyrene foam. She falls in a swimming pool of Fairy Snow washing powder, and watches the world turn Day-Glo. Behind nylon curtains are Perspex window panes, through which can be seen the acrylic road. She drives her polypropylene car on wheels of sponge and pulls into a Wimpy bar to have a rubber bun.

The x-rays were penetrating
 Through the latex breeze
 Synthetic fibre see-thru leaves
 Fell from the rayon trees
 The day the world turned dayglo.

In punk Day-Glo found its home again, in anti-nature, mass-consumer synthetics, garish offensiveness, an embrace of it all its vulgar connotations and all its power to shock and surprise. 'The World Turned Day-Glo' single

appeared in coloured vinyl, like so many other punk records. The Day-Glo-coloured vinyl punk record is not a black hole or empty meaning, but a circular assertion of anti-nature, of synthetic actuality. The record, which had been forgotten as item, as disc, is brought back into visibility by the coloured vinyl, of course in combination with the 7 by 7-inch artwork of the picture sleeve. The coloured disc hoped to detonate a mini-shock, at least a surprise as it was slipped from the cover. The record defied convention and being taken for granted. It became historical and artificial once more. Its cover was dressed in the colours of shock – Day-Glo, not as aid to psychedelic meditation and drugged experience, but as exposure. ‘Never trust a hippy’ was a poster in lurid yellow – its exhortation was against the Mr Natural associated with the 1960s. Punk exploited Day-Glo’s bargain-basement, eye-catching vulgarity. Jamie Reid’s cover for The Sex Pistols’ *Never Mind the Bollocks* adopted the look of a supermarket display, fused with a ransom note. This was consumer society staring itself in the face. With its outrageously yellow and pink cover and blockish black headline typography, the envelope for its polemical rants, the Sex Pistols’ *Never Mind the Bollocks* LP cover was as shocking as *Blast*. Despite its lurid appearance, the cover of *Never Mind the Bollocks* was no cheap thrown-together item: it relied on modern painterly technologies. The printing process was difficult, because, Reid says, yellow is a ‘notoriously bad colour to print as it shows up any impurities in the process very clearly’. The sleeve appeared crude and simple but it uses a series of complex overlays. He continues: ‘Fluorescent colours are hard to print as well, which doubled the difficulty.’ This colouration was fleeting and contingent: ‘It was a feature of the finished sleeve that it deteriorated very quickly: if left out in the sunlight, the yellow and the pink faded, just leaving the black of the overlays.’⁵⁸ And it had anonymity as its theme: not only on account of the snipped-out newspaper lettering, but also the lack of ‘stars’ on the cover. No phosphorescent stars sent back their celebrity light to illuminate the gloom of adolescent fantasy. The Sex Pistols, of course, did enstage themselves, not on the covers but elsewhere. However, this self-display refused interiority, turning their selves into mannequins, for Vivienne Westwood’s clothes, for Malcolm McLaren’s prank.

A LESSON IN CHEMISTRY AND VALUE: BRITAIN IN THE 1990S

Such prankery, proto-Situationist, anti-spectacular but fully spectacularized, seeded a movement. Offensive shock and the trashing of conventional values are not confined to the rarefied zone of the art world in the post-war period. One example provides a lesson on value from various perspectives. On 22 August 1994 Jim Cauty and Bill Drummond, The K Foundation, travelled to the island of Jura off the west coast of Scotland with a suitcase containing £1,000,000 in new £50 notes. Two others accompanied them as witnesses to the deed they were about to commit. In the early hours of the next morning

in a derelict boathouse Cauty and Drummond set the notes on fire. The paper burnt to ash in just under an hour. The ashes were swept into a suitcase. Money turned into rubbish. Money reduced to its chemical elements. At screenings of the film of the act, members of the audience were upset at the abolition of value, but they were flummoxed by Bill Drummond's insistence that there is still as much bread and rice in the world as before. A member of the audience persisted in arguing that something had been removed from the world. That something represented resources and in destroying it the link to the resources was destroyed too.⁵⁹ But they did not burn food, as food producers and their agents do each day in order to keep up prices on the world market. They did not lift one person out of poverty into millionaire status, nor did they buy a chocolate bar for 400,000 people. Instead, not knowing quite why they did it, they burnt £1,000,000, which is tantamount to burning an idea of something. Drummond speaks ruefully of how the £1,000,000 seemed a magic figure, of psychic significance, but now seems paltry after the multi-million-pound lottery wins. Until the winning of a billion, or the burning of a billion, is conceivable, there cannot be another magic number, another (al)chemical act of transformation, of money into art, of value into rubbish. This act by K Foundation led only to more questions and, from them, to exasperation and confusion. Marx might have predicted the responses, for from his first political-economic writings he had recognized that money, as the existing and active concept of value, confounds and exchanges everything. It is the universal *confusion* and *transposition* of all things; all natural and human qualities, the medium of an inverted world. Marx provided a motto for this incomprehension:

If money is the bond which ties me to *human* life and society to me, which links me to nature and to man, is money not the bond of all *bonds*? Can it not bind and loose all bonds? Is it therefore not the *universal means of separation*? It is the true *agent of separation* and the true *cementing agent*, it is the *chemical power* of society.⁶⁰

This chemical power binds and loosens, separates and cements. Money's destruction could only lead to more confusion. The very chemical power of society was turned to rubbish.

UNNATURAL WASTAGE: TODAY

My mind is like a plastic bag
That corresponds to all those ads
It sucks up all the rubbish
That is fed in through my ear
I eat Kleenex for breakfast

And use soft hygienic Weetabix
To dry my tears
(X-Ray Spex, 'Plastic Bag')

From my living room window under the bright spring sunlight I can see objects glinting as they sway in the wind. A plastic bag bobs gently caught on a tree branch. A thin brown ribbon twinkles in the breeze, twisted and snagged around twigs. It is magnetic audiotape. Yesterday I saw videotape, unfurled and jiggling like narrow strips of garland in the tree in front of our block. This is the city's new and own nature. These are the new natural forms, mainly native to poorer areas. This is plastic nature, offcuts of the industrial-synthetic world, its waste. Squashed chewing gum on paving stones outside the Camden Palace suggests the beginnings of a carpet of leaves in an autumn forest. Strip tags from orange-juice bottles nestle in kerbsides like sprinklings of flowers in hedgerows. Styrofoam packaging chips are the snowflakes we so rarely see. Cigarette ends dot the gutters and communal areas of council estates like seeds waiting to take root and bud. Now and again chocolate bar wrappers, crisp packets and carrier bags flutter and circle on the wind replacing the swooping London sparrows. But this new nature is not in all its parts organic, tied to animal, vegetable cycles of time. It is rather more like rock. Focus in on all this litter and a world of indestructible substances comes to light, its time geological, its life span virtually unlimited. It finds its way to landfill eventually, slowly, perhaps on its own terms. Once there, its crush of substance will breed cancer-causing toxins and untold chemical reactions.

When the hours of destruction in the Second World War came, some of the cities took their share of direct hits, and blackouts were the order of the night. The city was broken beyond repair from then on. The city of fragments imaged in modernism was unequivocally actualized in bomb damage. Its children grew up amongst the ruins. And the city of fragments grew, and generated more ruination and ruins. Its ruins found new uses, eventually, after those industries crumbled that had themselves produced not only commodities and raw materials, but the very cities themselves, as rubble was recycled into new buildings. Iain Sinclair brings one of these sites of ruination into focus. In *White Goods* (2002) he tells us how a walk along the 'pilgrimage path' of Bazalgette's Northern Outfall Sewer brings the stroller to the 'glorious absurdity' of Beckton Alp.⁶¹ The Beckton Alp was formed of an old slagheap on the site of Beck's Gas Light and Coke Company, which cooked up gas and in the process produced waste chemicals. These were reused in nearby manufactories for a hundred years till 1967. The Alp's earthy substance mingles with noxious tars and oozy oils and cyanide compounds. Its mountainous form is insecure, liable at any moment to collapse. Were it to so do, it might reveal whether the urban legend is true – at its heart there is buried an old steam train. From 1989 to 2001, when Iain Sinclair visited the

Alp, an artificial ski slope ran the length of it.⁶² What thing could present a vision that contrasted more starkly with the Romantic wanderer's sublime experience of a lofty mountainous aspect? Or rather, it repeats it in negative, a black hump. Here is the much-cited move from the sublime to the ridiculous, of course. Despite the Romantics' predilection for ruins as scenery, innocently Romantic wandering is difficult among these post-industrial shards. There is little space for human beings, and too much private or poisonous land.

To know London, to find its 'condition', Sinclair goes to its margins, out of the centre city, to its edges. He goes where all the refuse and the rags has drifted.⁶³ The focus draws outwards, to encompass a broader politics of land. The edges are visioned in close-up. Here he finds pastiche and flux and a crisis of historical memory.⁶⁴ Here he also finds scams, corruption and scandal, for example at London Waste Ltd in Edmonton, with its contaminated ash used for road building and for breeze blocks for homes on new satellite estates, 'conveniently' built with access to the M25, aka 'an asteroid belt for London's rubble'.⁶⁵ The metabolic rift can be seen most graphically here, pushed to the limits of the city. Given that for Sinclair the city is a type of body and the brain a type of road map, the rift itself has been shunted to the very periphery of consciousness too, to be recovered by Sinclair's walks where no person should willingly go. Sinclair calls this landscape not scenery but 'obscurity',⁶⁶ and contained in that word is the sense of being off-scene, off the stage, out of sight and out of mind. Sinclair describes places of no memory, forgotten places, places where memory is expunged in waves of rebuilding, re-destroying, places of transit, places, such as the London Orbital motorway, the M25, designed to pass through and keep moving on. Built against memory then, yet what Sinclair uncovers there are the things no-one knows they have forgotten. They burst out into Sinclair's poetic compote after some years' delay. Delay in time makes for layers in space. These layers are peeled off, or fleeced for their poetico-psychic resonances. Found is the social process of forgetting, the operation of marginalization. This consists variously in the pushing to the edge of socially necessary yet apparently ugly industry and its workers; the pushing to the edge of rubbish and the waste facilities that deal with it; the pushing to the edge of the disenfranchised and the mad. And then, insult on injury, the over-layering of these remnants by another process of forgetting: former madhouses become housing developments, conveniently placed for commuting and escape. Their publicity brochures suppress their scream-filled pasts. The towns flanking the motorway become places to drive by without recognition. Sinclair's research into that which has been forgotten slips certain spaces out of time, out of the one time, which is the time of commercial rationality. Modern commercial experience, the business-attracting one, the touristically appealing one, the publicized one resident in the centre of the city, the illusory spin-doctored one,⁶⁷ represents itself as purified, efficient, homogenous

and without anomaly. Re-found spaces, in contrast, are subject to delay, and so provide layers for ransacking.

Walter Benjamin went into exile from his home city. Here on the London Orbital we have an exile who is alienated inside the city that has been his home for so long. An alien image of sanitized experience is re-fused in the fast-cuts of Iain Sinclair's outer-fringe, off-cut London version. What results is an aesthetics of refuse, and more importantly a perspective on the city from the point of view of 'refuse' or those who are and that which is 'refused'. Such madness needs a method. The mad provide one, the schizophrenic point of view, the psychotic point of view. Who else but a psychotic would confront the ob-scenery in so paranoid a manner? Sinclair finds a figure to emulate: the *fugueur*, a model walker. One *fugueur* predecessor is Albert Dadas, a late nineteenth-century gas fitter from Bordeaux, who would set off, without warning or preparation, on long walks out of workaday life. Sinclair calls such walkers 'amnesiac pilgrims'. There is a hint of a scam here, with mental illness used as an alibi for absence from drudge-work. The *fugueur* abandons memory in favour of a 'heightened experience of present tense actuality'. Living in each moment leads to a loss of continuity and context, as just a series of fragmentary impressions is achieved. So afterwards, for Sinclair's purposes, the story of journey has to be reconstructed through hypnosis or memory prompts: a pile of photographs snapped so quickly that he cannot remember taking them. The fugue is a drift. Dadas prefigured Chtcheglov's wanderings, self-theorized in 'Formulary for a New Urbanism' of 1953, and taken up into the Situationists' delirious 'field-trips of disorientation'. But the fugue is more than just a drift, a dislocation from place, notes Sinclair. It is also a fracture. The rift is to be found here in the fugue. That is why the *fugueur* leads the reader of *London Orbital* to the asylum, for fracture suggests a split in the self, or between self and world, such as might be called madness. Who speaks, writes and knows the city is at issue here. In a variety of ways, the archetypal urban dweller today is the one who seeks asylums: asylum from the frantic fakery of the centre city, or asylum from global destruction, that is, asylum from wars waged economically and militarily. Asylum is a motive principle in *London Orbital* and its off-cuts, such as *White Goods*. Asylum seekers are ever returning in the writings, and they are the city's repressed, its disenfranchised, its refuse, its repelled, its unwanted, its screen of fantastical projection – in the form of the Eastern European immigrant Dracula, for one. But Sinclair stumbles quite literally on asylums – now forsaken – in the closed down mental homes around the M25. Figuratively too Sinclair seeks asylum, a temporary asylum from routine. As he notes: 'The fugue is a psychic commando course – Albert Dadas, bloody-footed, stomped seventy kilometres a day – that makes the parallel life, as gas fitter, hospital carer, or literary hack, endurable.'

Sinclair is the hack. The hack sells his writing services to anyone who will pay. He is a literary drudge. But in that word 'hack' there is another

sense: hacking as cutting up, smashing into pieces, a fracture, fissure, which could become a method of attack, splitting the seamlessness of modern homogenous sanitized existence. What is brought back into the city image by Sinclair's trip to its edges is the sense of a totality, a dense web of interconnections, where, despite official attempts at repression, nothing need be lost to signification and significance. In fact here is where everything has an excess of significance, to such an extent that the landscape is over-determined, pulsating with power, corruption, politics, fantasy, in much the same way as a field of experience might appear to a paranoid schizophrenic. Such a deranged perspective is common too to the artist who seeks to find significance, holographic meaning, in all materials, especially all human materials, that is to say, especially in rubbish, in waste, in madness. Sinclair describes the work of a fellow Hackney pulp-avant-gardist, Stewart Home. The London Borough of Hackney provided him with rich pickings: squats, Victorian properties decaying into the marshes, civic corruption, beggars, junkies, alcoholics and casualties of the mental health system. 'Home had simply to open his windows and plug in his word processor. The books wrote themselves.'⁶⁸

For those who want to look the usually overlooked parts of the city are seeped in myth. The city writes its own stories, in abandoned and unacknowledged daily lives. Literary montagists: they need not say anything, merely show. They purloin no valuables, appropriate no ingenious formulations. But the rags, the refuse – these they do not inventory but allow, in the only way possible, to come into their own: by making use of them. Home and Sinclair simply recycle what is there and not valued just as did Kurt Schwitters in his Merz works. In recycling rubbish, litter, trash, they do not relinquish the fractured perspective that made them realize how much potential significance might nestle in the dross. They acknowledge the rifts and the rubbish, real co-ordinates of our everyday lives, our chemical lives, our throwaway lives. In the junk world of a contemporary imagination new perspectives come to light out of materials old and new.

COLOUR REMAINS

Into a trash-filled world Day-Glo manufacturers and all the other chemists of colours pumped out their suspect colours, overly intense colours, off-colours, odd colours, wrong colours, chemical tints, colours that shine too brightly, too intensely, colours that warp the prism, violate the rainbow and shatter the spectrum. These are colours from somewhere else, glimpsed only in dreams or grotesque visions, some educed in the imagination, some cooked up in the laboratory to outdo the natural world. As the corporate manual from colour concoctors Day-Glo Color Corp.⁶⁹ in Cleveland, Ohio, puts it of its own particular contribution to brightening up the world:

Day-Glo fluorescent colors are like no other colors on the planet. They're not in the rainbow. We make them like this.⁷⁰

Colour is fragile and contingent. Colour is fleeting, fugitive, unstable, more attuned to the memory than to the objective world, always escaping or seeping away, fading as night falls or when the sun shines too brightly. Chemists struggle to make it last. Colour is motile. And in the realm of colour, chemical colour, synthetic colour, nothing remains the same as it was yesterday. Day-Glo Color Corp. researches its pigments and dyes, fixing them fast and faster in pens, paints, plastics, textiles. This is no second nature – no replication of already existing hues, but something else, another level, a 'third nature'.

And yet, even these craziest of colours resist an all-too-simple assimilation into a smoothly working world. Day-Glo Color Corp. uses a website to market its wares, but the personal computer and the Internet, hyped in the early 1990s as universal media of fantasy fulfilment in a world of pure *Schein*, cannot emulate convincingly the simple trick of Day-Glo. There is no true Day-Glo display on screen, only simulation. Phosphors in the monitor get visually within tolerance, depending on the lighting or the monitor, but true blazing fluorescence is not there. That is the problem with colour – it is so contingent, so circumstantial, so refractory. Perhaps, it is wise only to rely on the colours of dreams, of the mind's eye, the colours of fantasy, imagination, memory, which continue to shine brilliantly, even when the lights are off, your eyes are shut.

conclusion

Nature's Beautiful Corpse

REWIND

Through this book's twists and turns a 'poetics of carbon' was framed against the backdrop of an emergent mining industry and in relation to traces of alchemical thought and Romantic natural history and philosophy. Beneath the crust of the earth was a realm of untold riches, imagined in fairy-tales and Romantic stories. The underworld of riches was paralleled by an unconscious realm of the mind. Both mine and mind share much in common. For the Romantics the imaginative resource of the mine was also a tangible one, and poets were keen to discover ways of accessing the natural world, its minerals, its metals, its elements, finding them, bringing them to the surface, where necessary, naming them, understanding them, analysing and synthesizing them. In grasping this beautiful and manifold world investigators were directed by the philosophy of nature, with its sense of animism of the object world of nature and its notion of dynamic and polar forces at play. The productive results of this for chemistry were the experiments of F. F. Runge, considered in relation to Goethe's conception of nature. Runge's breakthroughs in the field of synthetic colour laid open the way for a vast German chemical industry and gave birth to the commercial lust to replicate all nature in test-tubes and vats. Runge's self-motivated experimentalism, even explicit in his vision of chemicals' self-propulsion, gives ground to an industrial scale of production for profit. Synthetic colours burst into the world, kaleidoscopic signs of nature's feigning in laboratories. But from the perspective of capitalist industry, nature was perceived as exploitable. After synthetic chemistry's substitution not just of colours but also of materials, nature seemed utterly dispensable. The imitation of nature in the laboratory suggested the possibility of an independence from nature and the inhabitation of a synthetic realm. There is one part of nature that synthesizes other parts of nature – humans, who exert energy in the transformation of nature. Those who expended the most energy, in physical terms, were the workers, who were massed in factories, in mines, in industrial installations, producing the pre-conditions for nature's emulation as well as the synthetic commodities.

Production, through human history, found a comprehensive theorist in Karl Marx. The system of industrial production created a hell on earth, and poisoned nature in all its parts. Marx's aim was the return of sensuous, aesthetic experience to the productive individual. One of the fundamental claims underlying his approach is that, from the perspective of freedom, there is a genuine exchange between the different parts of nature, that nature appeals sensuously to humans who are also nature. Marx's aesthetic concept of human life and production is revealed in his strong sense of the specific material properties (particularly the aesthetic qualities) of gold and gems. Through capitalist political economy, however, the notion of *Schein*, appearance, comes increasingly to dominate, industrially and in monetary terms. Underneath the enticing appearance of an abundance of commodities is a growing world of industrial waste and pollution. Marx and Engels recognized this, as did the chemists of colour, who raided the rubbish of production, but were less interested in the trash of consumption.

Marx's utopian grasp of human actuality is not an isolated stance. From Marx, or Fourier, through to the Frankfurt School theorists there is a theoretical tracking of the relationship between humans and nature, mediated via science and technologies. Science is the increasing knowledge of nature. Technology replaces natural force and sets into practice the insights of science. At points in history, technological advance and scientific endeavour are led by a cosmic utopian impulse. The stars and humans are brought into closer relation, through telescopes, and it is suggested that stars and humans are composed of the same matter. The invention of photography, the capturing of light on chemical papers, for our domestic consumption, makes graphic how the world outside is ours to capture, possess, frame and gaze upon. Here is suggested a poetry of inorganic materials in an apparently star-less, gas-lit city of artificial light, where the moon and the distant stars can now be chemically imprinted on a portable plate. Scale is altered, with the hugest, most distant, brought close, into the hands of humans. This technological wonder, just one of many issuing from an intense period of invention and promise, gives rise to utopian fantasies about realignments between humans, nature and the technical world. Scheerbart's is one such utopian fantasy with a world liberated through its technologies, which enable it to distance itself from natural dependence, from light and physical fixity. In such a dream of the future glass assumes moral qualities in a hopeful modernity when even war might become innocuous, if not abolished. This utopia of technology is, as Walter Benjamin, observes, deeply humanistic, because it imagines a technology that works in contract with nature, including humans, on an earth that 'forms a body in conjunction with humanity'.¹ Such fantasies might imagine an independence of humans from nature, a reorientation of life around artifice, artificial beauty, chemically attained and superior to nature's now pallid wonders. The Futurist and Vorticist aesthetic responds to this, rejecting the moon and the stars, for to represent them had become inauthentic and kitsch, either

because the prevalence of a new industrial world had made such sentiment redundant, or because of the over-use of these Romantic motifs, now conventionalized and degraded into cliché. Aesthetic spats were a part of modernism's ceaseless revolution in forms and styles, and Vorticists faced Futurists and Expressionists on the fields of France and, whatever their *ism*, blood was spilt. War was also big business and it brought in money all round. War's onslaught on nature, human and otherwise, was the climax of the metabolic fracture, resulting in an immolation of self.

After war came revolution, desperate and aborted attempts to abolish class society and liberate exploited nature. These failures to unite the working class gave way to nationalism and the birth of fascism. As this ideology was incubated, the non-utopian actuality of industrial development prevailed, visible in the textures of a rationalized daily life, evident not only in the working environments of white-collar workers, but also their leisure time. The artificial fluorescent light of new offices, such as IG Farben's showcase Frankfurt headquarters, revealed not only the marginalia of bureaucracy, allowing office workers to read their invoices and memos, but also illuminated a 'rationalized' world of crisis, in which 'distraction' silhouetted against neon was the ersatz escape, and which found its 'higher stage' in the Third Reich.

In the Third Reich synthetic products were cherished for their ability to deny the patina of passing time and the unpredictability of nature, upon which they ceaselessly improve. Substitutes abolished history and nature. They promised to increase the mastery of Nazi rulers over the natural world, including people. All spontaneity could be eradicated chemically and shortcuts could be abolished in the science of substitution. Technology came to be used quite specifically and dramatically against nature in the form of human life, arguably more brutally and at a higher degree than in any other form of capitalism. Against this deployment of science, scientists and scientific journalists in the Third Reich rewrote the story of chemistry in racial and nationalist ways. The conglomerate IG Farben became the absolute concern for the Thousand Year Reich. In the war years, chemistry served the demands of a war economy, serviced by forced labour, conscripted women and prisoners of war. IG Farben played a significant role, as was testified in the various trials after the war. But in a few areas that were shielded from the state's obtrusive eye some delved into the paradoxes of art and science in the 1930s and '40s. Under the cloak of science and technology, a covert art practice was released into the Third Reich. These modernist practitioners were influenced by F. F. Runge, Goethe and the Romantics. But victors in one sense, in that they managed to produce something against all odds, when nothing should have been produced, their combinatory vision of science and art lost out in the post-war period.

At the close of the Second World War the centre of scientific operation shifted westwards from Germany to the United States, and after that bloody war came the Cold War. In the victorious Allied countries, freezing and iciness

came to dominate the poetic and critical imaginary, as well as the popular one. Coldness dominated the enemies of capital, as much as its friends. A chilly aesthetics of pollution and revolution is apparent in the post-war writings of the Situationists and J. H. Prynne. The Situationists breathed in a cold air and expelled it as even frosty critique, directed at the reified contours of everyday life and the scientific fantasies of intellectuals who freeze-frame the world as a dead object for the purposes of analysis. In Prynne's intricate lyric drawing on the language of science and technology the rifts in knowledge gape. To outline them against the chill of contemporary life perhaps allowed the beginning of their reappropriation into a total body of knowledge. But the white-out negation was negated again in Punk's embrace of the over-bright rubbish colours of Day-Glo and its real-deal acknowledgement of the plastic, synthetic world. The colours of non-nature, anti-nature, vulgarity and cheapness decorated those who engaged in a high-pitched and negational shriek against conventional values.

The matter of rubbish never goes away, and it returns in its shabby, object form in Iain Sinclair's writings. Here it takes on the shape of the un-assimilatable, that which cannot be recycled within the terms of the system. Rubbish is capitalism's remainder, human or otherwise. It features as a point of hope and despair. The nature-human synthesis is yet to be properly achieved. The rift continues.

AFTERLIFE

But what of death, the final rubbish of humans? Funerary practices and the deposit of remains are increasingly inventive. The Toronto-based Images for Eternity and other companies offer artwork from cremated remains turned into paintings, often portraits of the dead one. Ashes are affixed on top of the finished art with several layers of sealant or they are mixed into paint. Celestis offers space burials, with the ashes compacted in a capsule and sent into orbit (before re-entering) or fired to the moon or into deep space (for ever). That which is legally a 'final deposition' can be commodified further in an effort to afford a technologically guaranteed sublime. They also offer a star-naming service.

At the start of the twenty-first century, a Chicago company announced that it had created a new way to memorialize loved ones: by turning their charred remains into a gem. The 'patent-pending' LifeGem offers to press the cremated ashes of a lost one into a diamond. You can have your loved one with you whenever you choose, which is something that no other memorial product offers, remarks Greg Herro, LifeGem's chief executive. 'Nothing else quite offers that everlasting love.'

It is a simple concept. People are made of carbon. Diamonds are made of carbon. Why not make diamonds out of people? The process is not dissimilar to the process of manufacturing synthetic diamonds from carbon since

the mid-1950s, when General Electric Co. developed the process for making small diamonds for industrial uses. Cremated ashes are heated to about 5,400°C. This burns off many of the impurities and the carbon in the ashes transforms into graphite. This graphite is shipped to the Technological Institute for Superhard and Novel Carbon Materials near Moscow, or to a secret laboratory in Germany (where else of course could this procedure happen?). Next the graphite is packed around a piece of diamond that is just a few thousandths of a millimetre across, and the crystallization process begins. This substance is then subjected for some weeks to intense pressure, 80,000 times the pressure of the atmosphere, and exposed to superheat, replicating the forces that create a natural diamond in the belly of the earth. As the LifeGem website FAQ states: 'LifeGem's unique technology replicates the process of what takes billions of years naturally for the earth to create and speeds it up to create a certified, high-quality diamond in just a matter of months.'

After this heat and pressure, a diamond, with a bluish tinge, emerges. Its blue comes from the human body's trace amounts of the element boron. Other colours, yellow and red, are on the books for the future, as is the pursuit of a clear diamond, with all impurities extracted. The diamonds are as real as any other, the makers claim, with the same brilliance, fire and hardness as any at Tiffany's. Round, radiant or princess cuts are available. A unique identifying number and an inscription of up to 75 characters can be etched by laser on the girth of the diamond. It is too small for the naked eye to see. Scientists are working to make the diamond bigger. The more money you give, the more carats you will get. In 2003 a one-quarter-carat blue diamond cost \$4,000 dollars, with a minimum order of two. A three-quarters-carat blue diamond cost \$17,000. The website lists prices for yellow diamonds, tinted 'like a sunset captured in time' (one carat: \$18,000), and red diamonds (one carat: \$22,000), once these become available. A LifeGem is 'rare because they come in colours uncommonly found in nature'. Rarity and uniqueness are promised in this imitation of nature:

Due to the unique nature of our scientific process, every single LifeGem will be a different shade. The elements and impurities in your loved one's carbon directly affect the resulting colour of your LifeGem(s).

Diamonds can be bought in advance of death, to secure today's prices. Each corpse can yield more than 100 diamonds. Each individual is a rich mine for those who own the 'the most advanced technology and knowledge in the diamond creation industry'. What is compressed into a jewel is seemingly more real, more essential than any other thing. 'The proprietary LifeGem creation process creates diamonds from the true essence of our loved ones, the carbon.'²

Carbon is located as the core of our loved ones, although the fact that it is the core of life itself, not just 'our loved ones', but everything living, is not acknowledged. Here is a curious echo of the Romantic insight into the oneness of nature, available here at a cost. It is a sentimental monument to 'individuality', and at exorbitant cost. Although perhaps the prices will fall. On 5 April 2004 Diamond Essence Co. took out a full page in the *New York Times*. 'Now for the first time there is a dazzlingly brilliant masterpiece to challenge the qualities of a mined diamond.' The laboratory diamond is better than the real thing. It has more fire, has virtually the same brilliance and, unlike a mined diamond, is 'virtually perfect'. The Diamond Essence jewel is 'not a mass-produced product', but rather the result of 'a relatively new and exclusive process' of mineral extraction, refinement and super-heating. This 'essence' of diamond improves so much on nature that the wealthy, including royalty, movie stars, celebrities and tv personalities choose to wear them instead of fallible natural diamonds. And these are cheap.

We return to the beginning – to the digging out of coal, to the scientific transformations that give up colourful reflections, that find life in death, colour in blackness, affinities between minerals and humans. All this is utopian as much as it is scientific. It is bizarre as much as it is productive. The connections between humans and nature are all there is – are essential, although not in the gushy way that LifeGem pretend – and through their connections and rifts these two have already given up so much.

References

introduction

- 1 Thomas Pynchon, *Gravity's Rainbow* (1973; London, 1995), p. 48.
- 2 Ibid., p. 164.
- 3 Ibid., p. 166.
- 4 One crucial source for the chemical details was Williams Haynes's chatty narrative in *This Chemical Age: The Miracle of Man-Made Materials* (New York, 1942). Another was Richard Sasuly, *16 Farben* (New York, 1947).
- 5 Pynchon, *Gravity's Rainbow*, p. 166.
- 6 Ibid., p. 167.
- 7 Ibid.
- 8 Theodor W. Adorno and Max Horkheimer, *Dialectic of Enlightenment* (1944; London, 1995).
- 9 Karl Marx, *The Eighteenth Brumaire of Louis Bonaparte* (1852) (London, 1984), p. 36.
- 10 The essay can be found in English in Stephen Bronner and Douglas Kellner eds, *Critical Theory and Society: A Reader* (New York, 1989), pp. 77–94. This quotation is on p. 78.
- 11 See the quotation from Leon Battista Alberti in Michael Baxandall, *Painting and Experience in Fifteenth Century Italy* (Oxford, 1988), p. 16.
- 12 See Karl Marx, *Capital*, vol. 1 (New York, 1906), p. 84.
- 13 Ibid., p. 87.
- 14 See Pynchon, *Gravity's Rainbow*, p. 167.
- 15 *Negative Dialectics* appeared in 1966, but Adorno noted that aspects of the book stemmed from the 1930s. See his editorial note on the German second edition.
- 16 See Adorno and Horkheimer, *Dialectic of Enlightenment*, p. 138. In German, *Dialektik der Aufklärung*, in *Gesammelte Schriften*, vol. III (Frankfurt am Main, 1986), p. 160.
- 17 Sasuly, *16 Farben*, pp. 4–5.
- 18 See Eric Schlosser, *Fast Food Nation: What the All-American Meal is Doing to the World* (Harmondsworth, 2001), p. 17. For more recent developments in relation to Chicken McNuggets, see p. 139.
- 19 Theodor W. Adorno, *Aesthetic Theory* (London, 1984), pp. 100–01; in German, *Ästhetische Theorie*, in *Gesammelte Schriften*, vol. VII (Frankfurt am Main, 1986), p. 107.
- 20 Walter Benjamin, *Selected Writings*, vol. IV: 1938–1940 (Cambridge, MA, 2003), p. 338.
- 21 See Theodor W. Adorno, *Negative Dialectics* (London, 1973), p. 403. In German, *Negative Dialektik*, in *Gesammelte Schriften*, vol. VI (Frankfurt am Main, 1986), p. 395.
- 22 Ibid., pp. 404–5 (translation modified); German edn, p. 396.
- 23 Ibid., p. 57 (translation modified); German edn, p. 66.

one

- 1 See Walter Benjamin, 'Berliner Kindheit um 1900' (1938), in *Gesammelte Schriften*, vol. VII, pt 1 (Frankfurt am Main, 1991), pp. 398–400. Another version appears in *Berliner Chronik* (1932), in *Gesammelte Schriften*, vol. VI (Frankfurt am Main, 1991), p. 472. It is in English as 'Berlin Childhood around 1900'; in Walter Benjamin, *Selected Writings*, vol. III: 1935–1938 (Cambridge, MA, 2002). A *Berlin Chronicle* of 1932 is in Benjamin, *Selected Writings*, vol. II: 1927–1934 (Cambridge, MA, 1999), pp. 600–1.
- 2 See Walter Benjamin, *Selected Writings*, vol. I: 1913–1926 (Cambridge, MA, 1996), p. 90.

- 3 Benjamin, 'Berlin Childhood around 1900', *Selected Writings*, vol. III, pp. 358–9. Biedermeier denotes the period from c. 1815–48, and denotes a cosy, domestic, middle-class existence.
- 4 Walter Benjamin, Notes for *Berliner Chronik*, in *Gesammelte Schriften*, vol. VI, p. 800.
- 5 In 1819 E.T.A. Hoffmann wrote a story about a miner's death at Falun in 1670. Others were inspired by the same true story. Heinrich Heine wrote a ballad. Richard Wagner sketched the outline for an opera called *Die Bergwerke von Falun*. Later Georg Trakl and Franz Fuhrmann used the theme.
- 6 Their first collection of folk-tales was initiated by Clemens Brentano, who sought out the Grimm brothers' help in compiling a continuation of his folk songs *Des Knaben Wunderhorn* (1805).
- 7 This story – a version of the 'Open Sesame' story from the Arabian *One Thousand and One Nights* – is in the Grimms' collection of fairy-tales of 1812–15.
- 8 F. J. Bertuch, *Über die Mittel Naturgeschichte gemeinnütziger zu machen und in das praktische Leben einzuführen* (Weimar, 1799), pp. 8–10.
- 9 *Ibid.*, p. 10.
- 10 See Friedrich von Hardenberg, 'Bericht an Abraham Gottlob Werner vom 28. April 1800 (*Über unsere Erdkohlenlager*)', Faksimileausgabe der Bergakademie Freiberg, (Freiberg, 1992).
- 11 Karl Marx, 'Debates on the Law on Thefts of Wood' (1842), *Collected Works Volume 1* (London, 1975), pp. 224–63.
- 12 Novalis, *Henry of Ofterdingen* (Cambridge, MA, 1842), p. 86.
- 13 *Ibid.*, p. 91.
- 14 *Ibid.*, p. 92.
- 15 Quoted in Lothar Pikulik, *Romantik als Ungentügen an der Normalität: Am Beispiel Tiecks, Hoffmanns, Eichendorffs* (Frankfurt am Main, 1979), p. 296.
- 16 John Desmond Bernal, 'The Flesh', in *The World, the Flesh and the Devil: An Enquiry into the Future of the Three Enemies of the Rational Soul* (London, 1929).
- 17 Cited in Benjamin, *Selected Writings*, vol. I, p. 147.
- 18 Cited in *ibid.*, p. 145.
- 19 Novalis, cited in *ibid.*
- 20 For a statement of this, see *ibid.*, p. 144. It is significant that Benjamin returns to Romantic theory in order to draw together art and science. He wrote his doctorate in 1919, after witnessing the devastating uses and effects of science and technology in the First World War.
- 21 Cited in *ibid.*, p. 145.
- 22 As Benjamin summarizes: 'the being known of one being by another coincides with the self-knowledge of that being which is being known, coincides with the self-knowledge of the knowing being and with the being-known of the knowing being by the being it knows.' *Ibid.*, p. 146.
- 23 Cited in *ibid.*, p. 148.
- 24 Fichte, quoted in *ibid.*, p. 147.
- 25 G.W.F. Hegel, *Lectures on the History of Philosophy* (1805–17; London, 1896), p. 517.
- 26 F. W. Schelling, *Ideas for a Philosophy of Nature* (Cambridge, 1988), p. 216.
- 27 Walter Benjamin makes this claim in his book of 1936, *Deutsche Menschen*, an edited collection of letters written between 1783 and 1883. Benjamin, *Selected Writings*, vol. III, p. 195.
- 28 The letter is included in *Deutsche Menschen*, *ibid.*, pp. 184–6.
- 29 Mary Shelley, *Frankenstein; or, The Modern Prometheus* (Harmondsworth, 1985), p. 53.
- 30 Ritter is German for knight.
- 31 Novalis, *Henry of Ofterdingen*, pp. 103–4.
- 32 *Ibid.*, p. 107.
- 33 *Ibid.*, p. 111.
- 34 Novalis, *The Disciples at Sais and Other Fragments* (London, 1903), p. 91.
- 35 G. H. Schubert, *Die Symbolik des Traumes* (Bamberg, 1814). Romantics influenced by it included E.T.A. Hoffmann, Justinus Kerner, Platen and Hebbel. One of Schubert's later influential works was a two-volume history of the soul, published in 1830. Schubert also wrote travel books, biographies of religious men, pedagogical literature, including the introduction to E. F. von Kauffmann's new edition of *Orbis pictus* by J. A. Comenius in 1841, and he also wrote fairy-tales and stories.
- 36 G. H. Schubert, *Ansichten von der Nachtseite der Naturwissenschaft* (Dresden, 1808). Coleridge's marginalia on his copy (held in the British Library) show an active reception of this work by English Romantics too.
- 37 Schubert, *Ansichten von der Nachtseite der Naturwissenschaft*, p. 210.
- 38 *Ibid.*, pp. 216–17.
- 39 *Ibid.*, p. 201.
- 40 *Ibid.*, p. 199.
- 41 See Theodore Ziolkowski, *German Romanticism and its Institutions* (Princeton, NJ, 1990), p. 33.
- 42 Quoted in Berthold Aft, *Friedrich Ferdinand Runge: Sein Leben und Werk* (Berlin, 1937), p. 58.
- 43 Samuel Christoph Wagener, *Das Leben des Erdballs und aller Welten: Neue Ansichten und Folgerungen aus*

- Thatsachen* (Berlin, 1828).
- 44 Ibid., p. iv.
- 45 Ibid., p. 16.
- 46 Hegel, *Lectures on the History of Philosophy*, p. 543.
- 47 This description stems from Hegel's critique of the bad philosophy of nature in *ibid.*, pp. 542–3.
- 48 Ibid., p. 543.
- 49 See G.W.F. Hegel, *Philosophy of Nature*, ed. and trans. M. J. Petry (London, 1970), vol. 1, pp. 215–16.
- 50 His scientific reading was thorough - his study of the philosophy of nature demonstrates knowledge of German, French and English journals.
- 51 Hegel, *Philosophy of Nature*, vol. III, p. 17.
- 52 Ibid., p. 18.
- 53 Schubert, *Ansichten von der Nachtseite der Naturwissenschaft*, pp. 215–6.
- 54 Franco Brunello, *The Art of Dyeing in the History of Mankind* (Venice, 1973), pp. 183–4.
- 55 Denounced by Marat as the 'son of a land-grabber, apprentice-chemist, pupil of the Genevan stock-jobber Necker, a Farmer General, Commissioner for Gunpowder and Saltpetre, director of the Discount Bank, secretary to the king, member of the Academy of Science, intimate of Vauvilliers, unfaithful administrator of the Paris Food Commission, and the greatest schemer of our times', Lavoisier was executed in 1794.
- 56 This is an image from Hegel's *Jena Realphilosophie*.
- 57 Anon., *Erzeugnisse unserer Arbeit* (Frankfurt am Main, 1938), p. 25.

two

- 1 Runge describes the meeting later, in a collection of letters written to educate housewives in science matters. See F. F. Runge, *Hauswirthschaftliche Briefe* (1866) (Leipzig, 1988), pp. 153–66.
- 2 For biographical details, see Berthold Anft, *Friedlieb Ferdinand Runge: Sein Leben und Werk* (Berlin, 1937).
- 3 Runge, cited in *ibid.*, p. 51.
- 4 Cited in *ibid.*, p. 58.
- 5 Ibid., p. 16. See also the entire university file reprinted in *ibid.*, pp. 153–66.
- 6 Ibid., p. 59.
- 7 This is how Berthold Anft explains the purchase, adding that the state sought 'independence from abroad'. Anft clearly sets parallels between state-economic policies in Germany in the early 1830s and those 100 years later, at his time of writing. It was for this reason that he was so critical when the firm was sold to Cochius as a private purchase in 1850. See *ibid.*, p. 31.
- 8 Ibid., p. 102.
- 9 Runge had creosote in solution before Reichenbach, notes Anft, and had discovered its antiseptic reaction (*ibid.*, p. 101).
- 10 In the fourteenth letter to housewives on chlorine and its relationship to the household, Runge describes how he discovered this synthetic blue dye. Runge, *Hauswirthschaftliche Briefe*, p. 22.
- 11 There were experiments prior to this working in the same area. In 1771 Woulfe treated indigo with nitric acid and discovered a yellow substance that dyed wool and silk. In 1779 Welter nitrated silk in another version of the same experiment. Both chemists had made picric acid, but without knowing it. In 1776 Scheele treated uric acid with nitric acid and evaporated the contents of the reaction. The reddish residue that appeared could dye skin. Scheele named it purpuric acid. In 1818 Proust prepared mureside from this. These experiments were not fully understood, but they were an unconscious groping towards the synthesizing of colour.
- 12 Runge's lack of reward for his discoveries and his management of the factory is detailed in Anft, *Friedlieb Ferdinand Runge*, pp. 31–40. The dispute, according to Anft, reveals the pernicious favouring of the administrator and businessman over the 'technical individual'.
- 13 Cited in Runge, *Hauswirthschaftliche Briefe*, p. 15.
- 14 Cited in *ibid.*, p. 3.
- 15 Gustav Bischof, *Populäre Briefe an eine gebildete Dame über die gesammten Gebiete der Naturwissenschaften* (Pforzheim, 1848), pp. iii–iv.
- 16 F. F. Runge, *Einleitung in die technische Chemie, für Jedermann* (Berlin, 1836), p. vii.
- 17 Ibid., p. 31.
- 18 Ibid., p. 545.
- 19 F. F. Runge, *Grundlehren der Chemie für Jedermann*, 3rd edn (Berlin, 1843), p. 425.
- 20 F. F. Runge, *Grundriss der Chemie* (Munich, 1848), p. 1.
- 21 Runge, *Hauswirthschaftliche Briefe*, p. 66.
- 22 Ibid., p. 69.
- 23 Cochius committed suicide in 1855 and his wife took over the business. That same year, she and Runge

- had a furious argument. As a result he lost his home and suffered a cut in his pension.
- 24 See F. F. Runge, Introduction, *Zur Farben-Chemie. Musterbilder für Freunde des Schönen und zum Gebrauch für Zeichner, Maler, Verzierer und Zeugdrucker (dargestellt durch chemische Wechselwirkung)* (Berlin, 1850).
- 25 Ibid.
- 26 Ibid.
- 27 Ibid.
- 28 Ibid.
- 29 Runge notes in *Zur Farben-Chemie* that the paper effects a separation of elements, and with this observation he may be credited with the discovery of chromatography.
- 30 Ibid.
- 31 Ibid.
- 32 Ibid.
- 33 Ibid.
- 34 J. W. Goethe, *Werke in 14 Bänden*, 9th edn (Hamburg, 1981), vol. xiii, pp. 5–6.
- 35 John Tyndall's explanation for the blue of the sky as an effect of blue light scattered back by small particles came in 1859. It would also be realized that the blue colour receptors in the eye are stimulated most strongly by the large amount of scattered blue, indigo and violet light in this instance. Were those seeing eyes to be blue, then their own colour would be a result of the same effect, as is the opalescence of gemstones and the hue in the blue jay's wing.
- 36 J. W. Goethe, *Maximen und Reflexionen* (Leipzig, 1941), p. 203.
- 37 Ibid., pp. 98–9.
- 38 Ibid., p. 97.
- 39 J. W. Goethe, *Theory of Colours*, trans. Charles Lock Eastlake (Cambridge, MA, 1970), p. xl.
- 40 J. W. Goethe, 'Analyse und Synthese', *Werke in 14 Bänden*, vol. xiii, pp. 49–52. It was published posthumously in 1833.
- 41 Goethe, *Werke in 14 Bänden*, vol. xiii, p. 36.
- 42 Runge uses the word 'sinnig', which conjures up the notion of *Sinnen*, the senses.
- 43 Runge, *Hauswirthschaftliche Briefe*, p. 166.
- 44 He uses this term when discussing image 21 in his collection *Der Bildungstrieb der Stoffe*.
- 45 Runge, Conclusion, *Der Bildungstrieb der Stoffe*.
- 46 Ibid.
- 47 Ibid.
- 48 Ibid.
- 49 Runge, *Hauswirthschaftliche Briefe*, frontispiece.
- 50 From a letter to Adalbert von Chamisso, cited in Otto-Joachim Grüsser, *Justinus Kerner, 1786–1862: Arzt, Poet, Geisterscher* (Heidelberg, 1987), p. 217.
- 51 Runge, Conclusion, *Der Bildungstrieb der Stoffe*.
- 52 Runge, *Hauswirthschaftliche Briefe*, p. 153. Runge's ideas in 1866 on the metamorphosis of plants echo his first writings on phytology from the early 1820s.
- 53 Ibid., pp. 153–4.
- 54 Ibid., p. 154.
- 55 Ibid., p. 156.
- 56 Ibid., p. 157.
- 57 Ibid.
- 58 Ibid., p. 158.
- 59 Ibid., pp. 160–61.
- 60 Ibid., pp. 164–5. Runge is quoting Goethe's 'The Metamorphosis of Plants' here.
- 61 The women of Oranienburg wrote a poem for Runge, praising him as an adviser of housewives, cooks and washerwomen. It was found after his death amongst his unpublished papers.
- 62 Karl Marx, 'Economic and Philosophical Manuscripts' (1844), *Early Writings* (London, 1975), p. 356.
- 63 See Y. M. Uranovsky, 'Marxism and Natural Sciences', in *Marxism and Modern Thought*, ed. N. I. Bukharin *et al.* (London, 1935), p. 140. See also John Bellamy Foster, *Marx's Ecology: Materialism and Nature* (New York, 2002).
- 64 Karl Marx and Friedrich Engels, *The Holy Family; or, Critique of Critical Criticism* (1844; Moscow, 1975), p. 151.
- 65 Marx, 'Economic and Philosophical Manuscripts', p. 353 (translation modified).
- 66 Ibid.
- 67 Ibid., pp. 322–57.
- 68 Ibid., p. 328.
- 69 Ibid., p. 351.
- 70 Ibid., p. 329.

- 71 Ibid., p. 355 (translation modified).
- 72 Karl Marx and Friedrich Engels, *Correspondence of Marx and Engels: Selected Correspondence, 1846–1895* (London, 1941), p. 113. Marx read Grove's *The Correlation of Physical Forces*, the work of 'the most philosophical naturalist' among the English and German scientific investigators, according to Uranovsky in 'Marxism and Natural Sciences'.
- 73 Marx and Engels, *Correspondence*, p. 114.
- 74 Ibid., p. 113.
- 75 Karl Marx, Preface to the First German Edition, *Capital*, vol. I (New York, 1906), p. 12.
- 76 Ibid.
- 77 Laboratories in factories were common in Germany from 1868. In Britain and France there was none before the First World War.
- 78 Cited in Walter Greiling, *Chemie Erobert die Welt* (Berlin, 1943), p. 121.
- 79 Franco Brunello, *The Art of Dyeing in the History of Mankind* (Venice, 1973), p. 284.
- 80 See Friedrich Sieburg, *Revolution im Unsichtbaren* (Bayer, 1963).
- 81 Friedrich Engels, *Ludwig Feuerbach and the Outcome of Classical German Philosophy* (1888; London, 1941), p. 33.

three

- 1 Meister, Lucius & Co. extended its name in 1867, two years after Brüning joined.
- 2 See further details in Bob Edwards, *Chemicals: Servant or Master? Life or Death?* (London, 1947), pp. 19–29.
- 3 Karl Marx, Preface to the First German Edition, *Capital*, vol. I (New York, 1906), p. 13.
- 4 Ibid., pp. 484–5.
- 5 Ibid., p. 325.
- 6 Ibid., p. 523.
- 7 Helga Krohn et al., *Geschichte der Farbwerke Hoechst und der chemischen Industrie Deutschland* (Offenbach, 1989), p. 11.
- 8 Karl Marx, *Capital*, vol. III (Moscow, 1971), p. 71.
- 9 Ibid.
- 10 Marx, *Capital*, vol. I, pp. 201–2.
- 11 Letter from Marx to Adolf Cluss, 5 October 1853; Karl Marx and Friedrich Engels, *Collected Works*, vol. xxxix (London, 1987), p. 382.
- 12 Schönbein also discovered nitro-cellulose or guncotton in 1845.
- 13 Letter from Marx to Engels, 13 February 1866, in Marx and Engels, *Collected Works*, vol. XLII, p. 227.
- 14 Marx, *Capital*, vol. III, p. 651.
- 15 John Bellamy Foster, in his *Marx's Ecology: Materialism and Nature* (New York, 2000), discusses the relationship between Liebig and Marx in terms of the idea of 'metabolic exchange' and 'rift'.
- 16 See Justus von Liebig, *Letters on the Subject of the Utilization of the Municipal Sewage* (London, 1865), p. 27.
- 17 Ibid.
- 18 Ibid., p. 20.
- 19 Ibid., p. 21.
- 20 This is part of the title of his treatise on Oranienburg guano, published in 1858.
- 21 Marx, *Capital*, vol. I, pp. 663–4.
- 22 Marx, *Capital*, vol. III, p. 101.
- 23 Ibid., p. 102.
- 24 Ibid.
- 25 Given the poor quality of the materials, which wore out quickly and had to be replaced, this was a larger-scale version of unscrupulous market practices as noted by Engels in his *Condition of the Working Classes in England* of 1845: the selling of salted butter as fresh, the lumps covered with a coating of fresh butter, or a pound of fresh laid on top to taste, and then the satisfied punters are sold what is underneath; sugar adulterated by pounded rice, boiled soap refuse and other cheap materials; coffee mixed with chicory, cocoa commingled with fine brown earth, treated with fat; dry tea-leaves roasted on hot copper plates, to change their colour to the colour of fresh leaves; tobacco faked from anything suitable; pounded nutshells added to pepper and port-wine manufactured from alcohol and dyestuffs. Friedrich Engels, *The Condition of the Working Classes in England* (1845; London, 1936), pp. 69–70.
- 26 See Andrej Anikin, *Gold* (Berlin, 1980), p. 38.
- 27 Karl Marx, *Grundrisse: Foundations of the Critique of Political Economy* (1857–8; Harmondsworth, 1973), pp. 173–4.
- 28 In contrast, platinum lacks colour, is too rare and was unknown in antiquity, for it was found only after the discovery of America. Iron, copper, tin, lead and silver are ordinarily discovered in chemical

- combinations with oxygen, sulphur, arsenic or carbon.
- 29 Silver always requires the technological ability to mine. Because of this high level of technical development, the value of silver is initially higher than gold, though it is less scarce a metal. However, its value falls in relation to that of gold as the productive powers of labour develop.
 - 30 Marx bases his analysis of gold's properties on 'Lectures on Gold for the Instruction of Emigrants about to Proceed to Australia', delivered at the Museum of Practical Geology, London, in 1852 and organized by the Government School of Mines and Science Applied to the Arts.
 - 31 Karl Marx, *A Contribution to the Critique of Political Economy* (1859; Moscow, 1977), pp. 154–5.
 - 32 *Ibid.*, p. 155.
 - 33 *Ibid.*
 - 34 Karl Marx and Friedrich Engels, *The Holy Family; or, Critique of Critical Criticism* (1844; Moscow, 1975), p. 151.
 - 35 Marx, *Critique of Political Economy*, p. 155.
 - 36 William Petty, 'Quantulumcunque Concerning Money' (1682), variously collected including in *The Somers Collection of Tracts*, vol. viii (London, 1812).
 - 37 Marx, *Capital*, vol. 1, p. 141.
 - 38 See John Locke, 'Further Considerations Concerning Raising the Value of Money' (1695), in *Essays* (London, 1883), pp. 648–98.
 - 39 *Ibid.*, p. 655.
 - 40 For some thoughts on alchemy, Newton, Keynes and monetarism, see Michael Neary and Graham Taylor, 'Marx and the Magic of Money: Towards an Alchemy of Capital', *Historical Materialism*, 11 (Summer 1998), pp. 99–117.
 - 41 G.W.F. Hegel, *Phenomenology of Spirit* (Oxford, 1977), p. 22.
 - 42 A counter image to this could be Samuel Johnson. Johnson was a lexicographer. This was a menial job, serving up words, fixing meanings rather than creating them. In addition, Johnson saw it as his lexicographer's duty to provide moral instruction for the semi-educated and so his business was weighty, but dull, a chore all round, and only to be done for financial recompense. In 1759, needing money to pay for his mother's funeral, he wrote *Rasselas, Prince of Abyssinia*. It took a week and was barely subject to revisions. In his journal *The Idler*, in April 1759, he noted that the powers found in *Rasselas* were necessitated by 'great exigencies', one of those necessities which break open the 'golden cavern'. In *Rasselas* a character named Pekuah is worth 'two hundred ounces of gold' and craves money. Elsewhere Johnson declared that writers produce for money, and insists it is so and must be so. To act otherwise would be the rank stupidity of a blockhead. Johnson's statement recognizes brute economic actuality. It is realistic, not idealistic. That was Johnson's business, and he could more than imagine being paid by the word. He despised linguistic ambiguity for the moral and political threat it posed. He was, after all, paid for nailing down meanings and, so, halting the proliferation of language, the circulation of unmonitored signs. Rigidity sets in on language and meaning. But Johnson was also expressing good old blank English instrumentalist empiricism, such as that promoted by the Royal Society. This demanded clear language, mathematical plainness, and preferred the language of artisans, countrymen or merchants to that of wits or scholars. The value of money was blunt and deflated the claims of literature and poetry.
 - 43 Marx, *Critique of Political Economy*, p. 108.
 - 44 *Ibid.*, p. 109.
 - 45 *Ibid.*, p. 113.
 - 46 *Ibid.*, p. 114.
 - 47 Marx, *Capital*, vol. 1, p. 148.
 - 48 Karl Marx, 'Economic and Philosophical Manuscripts', in *Early Writings* (London, 1975), pp. 378–9.
 - 49 *Ibid.*, p. 361.
 - 50 Marx, *Capital*, vol. iii, p. 393.
 - 51 Marx, 'Economic and Philosophical Manuscripts', p. 376.
 - 52 *Ibid.*, p. 377.
 - 53 See J. W. Goethe, *Faust 1 & II*, vol. II: *The Collected Works*, ed. and trans. Stuart Atkins (Princeton, NJ, 1994).
 - 54 *Ibid.*, line 4889 onwards.
 - 55 *Ibid.*, line 6054 onwards. The following lines are from Stuart Atkins's translation.
 - 56 Ludwig Feuerbach, *The Essence of Christianity*, 2nd edn, trans. Marian Evans (London, 1881), p. xiii.
 - 57 See Marx, *Capital*, vol. 1, p. 41.
 - 58 *Ibid.*, p. 84.

four

- 1 Walter Benjamin, *Selected Writings*, vol. IV: 1938–1940 (Cambridge, MA, 2003), p. 41.

- 2 Walter Benjamin, *The Arcades Project* (Cambridge, MA, 1999), p. 875.
- 3 Ibid., p. 539.
- 4 Ibid., p. 540.
- 5 Ibid., p. 834.
- 6 Edgar Allan Poe, *The Works of Edgar Allan Poe* (London, 1873), p. 673.
- 7 For Benjamin's expression of this, see the section on 'Baudelaire or the Streets of Paris', in Benjamin's exposé of *The Arcades Project* of 1935.
- 8 Cited in Benjamin, *The Arcades Project*, p. 537.
- 9 Poe, *Works*, p. 674.
- 10 Ibid., pp. 675–6.
- 11 This image is taken from Adorno's study of Kierkegaard and is quoted in Benjamin, *The Arcades Project*, p. 542.
- 12 See Benjamin, 'Kleine Geschichte der Photographie' (1931), in *Gesammelte Schriften*, vol. II, pt 1 (Frankfurt am Main, 1991), p. 370. In English in Benjamin, *Selected Writings*, vol. II: 1927–1934 (Cambridge, MA, 1999), p. 508.
- 13 See *Gesammelte Schriften*, vol. VII, pt 1 (Frankfurt am Main, 1991), p. 360. In English in Benjamin, *Selected Writings*, vol. II.
- 14 Benjamin, *The Arcades Project*, p. 631.
- 15 Robert Boyle, *Occasional Reflections upon several subjects whereto is premis'd a discourse about such kind of thoughts* (London, 1665), p. 172. For the initial prompt for this discussion of twinkling stars, see J. H. Prynne, 'Stars, Tigers and the Shape of Words', William Matthews Lecture, Birkbeck, University of London, 1993. Prynne addresses this passage on p. 47.
- 16 Boyle, *Occasional Reflections*, p. 173.
- 17 Ann Taylor and Jane Taylor, 'The Star', in *Rhymes for the Nursery* (London, 1814), pp. 10–11.
- 18 Karl Marx, *Capital*, vol. I (New York, 1906), p. 95.
- 19 Ibid., p. 94.
- 20 Ibid., p. 47.
- 21 Reported in the *Boston Daily Advertiser*, 23 February 1839, and quoted on the byways of the World Wide Web.
- 22 As reported in Benjamin, *The Arcades Project*, p. 271.
- 23 Walter Benjamin, *Zentralpark*, in *Gesammelte Schriften*, vol. I, pt 2 (Frankfurt am Main, 1991), p. 684.
- 24 Ibid., p. 670.
- 25 Ibid., p. 660.
- 26 Ibid., p. 668.
- 27 See, for example, the 1881 edition of the book from T. Nelson and Sons, one of many editions published during the nineteenth century, and proof that the rhymes wormed their way into many children's memories.
- 28 See Benjamin, *The Arcades Project*, p. 343.
- 29 Ibid., p. 834.
- 30 Ibid., p. 673.
- 31 Ibid., p. 674.
- 32 Ibid., p. 419.
- 33 This is Benjamin's phrase in his essay of 1933, 'Experience and Poverty', in his *Selected Writings*, vol. II, pp. 733–4.
- 34 Paul Scheerbart, *Glasarchitektur* (Berlin, 1914), p. 81.
- 35 Cited in Benjamin, *The Arcades Project*, p. 564.
- 36 Scheerbart, *Glasarchitektur*, p. 21.
- 37 Ibid., p. 54.
- 38 Ibid., p. 69.
- 39 Ibid., p. 97.
- 40 Ibid., p. 58.
- 41 Ibid., p. 62.
- 42 Ibid., p. 119.
- 43 Ibid., p. 109.
- 44 Paul Scheerbart, *Münchhausen und Clarissa* (Hamburg, 1991), pp. 72–3.
- 45 Ibid., pp. 19–20.
- 46 Ibid., p. 21.
- 47 Ibid., pp. 26–7.
- 48 Paul Scheerbart, *Immer Mutig!* (1902) (Frankfurt am Main, 1990), p. 190.
- 49 See Benjamin, *Gesammelte Schriften*, vol. VI (Frankfurt am Main, 1991), pp. 147–8.
- 50 See Benjamin, 'Zu Scheerbart' (late 1930s), *Gesammelte Schriften*, vol. II [(Frankfurt am Main, 1991), pt. 2, p. 630. In English in Benjamin, *Selected Writings*, vol. IV.

- 51 Ibid., p. 632.
- 52 Heydrich's provisional assessment reported to Göring that 815 shops, 29 department stores and 171 dwellings of Jews had been burnt or otherwise destroyed. Heydrich greatly underestimated the number of synagogues set on fire or demolished, which he set at 267.
- 53 Glass and steel architecture was not entirely banished. It was suitable for the modern sites of transportation, such as new railway stations in Berlin and Munich. Factories might even retain elements of this 'new building' style, inasmuch as it was 'functional'. Mies van der Rohe and Walter Gropius tried, early on, to come to an accommodation with their new masters.
- 54 André Breton, *Nadja* (1928; Paris, 1964), pp. 18–19.
- 55 André Breton, *The Second Manifesto of Surrealism* (1930), in his *Manifestos of Surrealism* (Ann Arbor, MI, 1972), pp. 123–4.
- 56 Benjamin, *Gesammelte Schriften*, vol. II, p. 1006.
- 57 See Walter Benjamin, 'Selbstbildnisse eines Träumenden', in *Gesammelte Schriften*, vol. IV, pt 1 (Frankfurt am Main, 1991), pp. 420–25.
- 58 See Benjamin, *The Arcades Project*, p. 389.
- 59 Ibid., p. 841.
- 60 Benjamin, *Gesammelte Schriften*, vol. I, pt 3 (Frankfurt am Main, 1991), p. 1252. See also Benjamin, *The Arcades Project*, p. 843. For an earlier use of the term, see Benjamin, *The Origin of German Tragic Drama* (London, 1977), p. 34.
- 61 Walter Benjamin, *Selected Writings*, vol. II, p. 685 (translation modified).
- 62 Benjamin, *The Arcades Project*, p. 392.
- 63 See the diagram in Willi Bolle's 'Geschichte', in *Benjamins Begriffe*, ed. Michael Opitz and Erdmut Wizisla (Frankfurt am Main, 2000), pp. 399–442.
- 64 Walter Benjamin, *Briefe* (Frankfurt am Main, 1978), vol. II, p. 688.
- 65 Benjamin, *The Arcades Project*, p. 400.
- 66 Walter Benjamin 'The Work of Art in the Age of its Technical Reproducibility', thesis III.
- 67 See Holly Henry, *Virginia Woolf and the Discourse of Science: The Aesthetics of Astronomy* (Cambridge, 2003), p. 115.
- 68 Cited in *ibid.*, p. 43.
- 69 Cited in *ibid.* It stems from the *New York Times Magazine*, 11 August 1929.
- 70 Benjamin, 'Zu Scheerbart', in *Gesammelte Schriften*, vol. II, pt 2 (Frankfurt am Main, 1991), p. 630. In English in Benjamin, *Selected Writings*, vol. IV, p. 386.
- 71 Benjamin, *Selected Writings*, vol. II, p. 733.

five

- 1 See the collection of historical labels in *Farb Werke: Historische Etiketten* (Frankfurt am Main, 1985).
- 2 See Douglas Goldring in Richard Cork, *Vorticism and Abstract Art in the First Machine Age*, vol. I: *Origins and Developments* (London, 1976), p. 250.
- 3 Cited in Paul O'Keefe, *Some Sort of Genius: A Life of Wyndham Lewis* (London, 2000), p. 156.
- 4 *Blast: Review of the Great English Vortex* (London, 1914), p. 149.
- 5 See Wyndham Lewis, *Blasting and Bombardiering* (1937) (London, 1967), pp. 32–5.
- 6 Wyndham Lewis, *Rude Assignment: An Intellectual Autobiography* (1950; Santa Barbara, CA, 1984), p. 135.
- 7 Cork, *Vorticism and Abstract Art*, vol. I, p. 235.
- 8 Lewis, *Blasting and Bombardiering*, p. 37.
- 9 As reported in an advertising blurb in *Blast: The War Issue* (London, 1915), back materials.
- 10 See O'Keefe, *Some Sort of Genius*, p. 157.
- 11 Cork, *Vorticism and Abstract Art*, vol. I, p. 263.
- 12 Violet Hunt quoted in *ibid.*, p. 265.
- 13 *Blast: Review of the Great English Vortex*, opening page.
- 14 *Ibid.*, p. 30.
- 15 *Ibid.*, p. 33.
- 16 O'Keefe, *Some Sort of Genius*, p. 155.
- 17 *Blast: Review of the Great English Vortex*, p. 146.
- 18 *Ibid.*, p. 134.
- 19 *Ibid.*
- 20 *Ibid.*, p. 142.
- 21 *Ibid.*, p. 146.
- 22 *Ibid.*, p. 145.
- 23 *Ibid.*, p. 130.
- 24 Lewis, *Rude Assignment*, p. 135.

- 25 Cork, *Vorticism and Abstract Art*, vol. 1, p. 243.
- 26 *Blast: Review of the Great English Vortex*, p. 49.
- 27 *Blast: War Issue*.
- 28 *Ibid.*, p. 39.
- 29 Lewis mocks the futility of this aim in *Blast: Review of the Great English Vortex*, p. 131.
- 30 *Blast: War Issue*, p. 77.
- 31 *Ibid.*, p. 82.
- 32 *Ibid.*, p. 47.
- 33 *Ibid.*, p. 46.
- 34 *Ibid.*
- 35 *Ibid.*
- 36 *Ibid.*, p. 79.
- 37 *Ibid.*, p. 77.
- 38 *Blast: Review of the Great English Vortex*, p. 141.
- 39 *Blast: War Issue*, p. 5.
- 40 Helga Krohn et al., *Geschichte der Farbwerke Hoechst und der chemischen Industrie Deutschland* (Offenbach, 1989), p. 34.
- 41 *Ibid.*, p. 41.
- 42 Bayer-Gefahren, ed., *IG Farben, Von Anilin bis Zwangsarbeit: Zur Geschichte von BASF, Bayer, Hoechst und anderen deutschen Chemie-Konzernen* (Stuttgart, 1995), p. 75.
- 43 The loans were not repaid until the inflation of the early 1920s had cancelled much of their value.
- 44 Bayer-Gefahren, ed., *IG Farben*, p. 19.
- 45 See 'Die Waffen von Morgen', in Walter Benjamin, *Gesammelte Schriften*, vol. IV, pt 1 (Frankfurt am Main, 1991), pp. 473–6.
- 46 Ernst Jünger, *In Stahlgewittern: Aus dem Tagebuch eines Stosstruppführers* (Berlin, 1922), pp. 195–6.
- 47 *Ibid.*, pp. 87–8.
- 48 *Blast: Review of the Great English Vortex*, p. 146.
- 49 For documents and discussion of 'Der Sturm', see Rose-Carol Washton-Long, ed., *German Expressionism: Documents from the End of the Wilhelmine Empire to the Rise of National Socialism* (New York, 1993).
- 50 For examples of Expressionist postcards, see Gerhard Wietek, *Gemalte Künstlerpost: Karten und Briefe deutscher Künstler aus dem 20. Jahrhundert* (Munich, 1977).
- 51 For details on the history of the postcard within the German postal system, see *Abgestempelt: Judenfeindliche Postkarten*, exh. cat. (Heidelberg, 1999).
- 52 See Bernhard Siegert, *Relais: Geschichte der Literatur als Epoche der Post, 1751–1913* (Berlin, 1993).
- 53 Some of the material in the next few pages found an earlier form in the section 'Low-cost Alterations', in my essay 'Philistines and Art Vandals Get Upset', in *The Philistine Controversy*, ed. Dave Beech and John Roberts (London, 2002), pp. 201–27.
- 54 See Edward Timms, *Karl Kraus: Apocalyptic Satirist* (New Haven, 1989), p. 45.
- 55 See *ibid.*, pp. 143–4. Also *Karl Kraus*, exh. cat. (Marbach am Neckar, 1999), pp. 231–8.
- 56 Timms, *Karl Kraus*, p. 378.
- 57 See Robert Payne, *The Life and Death of Adolf Hitler* (New York, 1973), pp. 85 and 88.
- 58 The two described below are reproduced in the Marbacher Katalog on *Karl Kraus*.
- 59 Helga Krohn et al., *Geschichte der Farbwerke Hoechst*, p. 52.
- 60 *Ibid.*, p. 61.
- 61 *Ibid.*, p. 54.
- 62 Richard Sasuly, *IG Farben* (New York, 1947), p. 53.
- 63 A. Clarke, *Coal Tar Colours in the Decorative Industries* (London, 1922), pp. v–vi.
- 64 Some of this discussion of Franz Jung first appeared as parts of an essay in the collection *The Twentieth Century: A Century of Wars and Revolutions?*, ed. Keith Flett and David Renton (London, 2000), pp. 33–53.
- 65 For more detail see his autobiography, Franz Jung, *Der Weg nach Unten* (1961) (Hamburg, 1988).
- 66 See Helga Krohn et al., *Geschichte der Farbwerke Hoechst*, p. 64.
- 67 See Gerald D. Feldman, *The Great Disorder: Politics, Economics and Society in the German Inflation, 1914–1924* (Oxford, 1997), p. 640.
- 68 See Chris Harman, *The Lost Revolution: Germany, 1918–1923* (London, 1982), p. 229.
- 69 See Bozena Choluj, *Deutsche Schriftsteller im Banne der Novemberrevolution 1918* (Wiesbaden, 1991), p. 135.
- 70 See Franz Jung, *Die Eroberung der Maschinen* (Berlin, 1923), p. 172.
- 71 Cited in Georgy Márkus, 'Life and the Soul', in *Lukács Revalued*, ed. Agnes Heller (Oxford, 1983), p. 24.
- 72 Detlev Peukert, *The Weimar Republic* (Harmondsworth, 1993), p. 62.
- 73 See A. Clarke, *Coal Tar Colours in the Decorative Industries* (London, 1922), pp. 121–2.
- 74 The essay was published in *Pravda*, no. 251 (6–7 November 1921). See V. I. Lenin, *Collected Works*, vol. xxxiii (Moscow, 1965), pp. 109–16.

- 75 Walter Benjamin, *Gesammelte Schriften*, vol. iv, pt 2 (Frankfurt am Main, 1991), p. 934.
- 76 Walter Benjamin, *Selected Writings*, vol. 1: 1913–1926 (Cambridge, MA, 1996), p. 481.
- 77 See *50 Years Bauhaus*, exh. cat., Royal Academy of Arts (London, 1968), p. 118.
- 78 Cited in Caroline Hille, 'Neue Sachlichkeit: Deutsche Malerei seit dem Expressionismus', in *Stationen der Moderne*, ed. Eberhard Roters (Cologne, 1985), p. 144.
- 79 V. I. Lenin, *Materialism and Empirio-criticism* (1908) (Beijing, 1972), p. 110.
- 80 Georg Lukács, *A Defence of History and Class Consciousness: Tailism and the Dialectic* (London, 2000), pp. 124–5.
- 81 *Ibid.*, p. 126.
- 82 *Ibid.*, p. 130.
- 83 *Ibid.*, p. 131.
- 84 The newsletter article is reprinted in Helga Krohn *et al.*, *Geschichte der Farbwerke Hoechst*, p. 71.
- 85 Carl Duisberg, 'Zum Geleit', in *Das Echo: Deutsche Export-Revue*, no. 25 (18 June 1925); reprinted in Carl Duisberg, *Abhandlungen, Vorträge und Reden aus den Jahren 1923–1933* (Berlin, 1933), p. 15.
- 86 Carl Duisberg, speech given at a German industry conference on 24 June 1925; reprinted in Duisberg, *Abhandlungen*, pp. 23–4.
- 87 *Ibid.*, p. 24.
- 88 Carl Duisberg, Report to the German industry conference of 24–5 June 1925; reprinted in Duisberg, *Abhandlungen*, p. 31.
- 89 Carl Duisberg, '100-Jahr Feier der Industrie- und Handelskammer zu Düsseldorf am 23. Juni 1931 in Benrath', reprinted in *ibid.*, p. 134.
- 90 See Donny Gluckstein, *The Nazis, Capitalism and the Working Class* (London, 1999), p. 46.
- 91 Helga Krohn *et al.*, *Geschichte der Farbwerke Hoechst*, p. 48.
- 92 For a description of the building, see Peter Cachola Schmal, 'Der Kunde ist König: Zum Einfluss des Bauherrn IG Farbenindustrie AG auf die Entstehung der Grüneburg', in *Der Poelzig-Bau, Vom IG Farben-Haus zur Goethe-Universität*, ed. Werner Meissner *et al.* (Frankfurt am Main, 1999), pp. 47–59.
- 93 See Siegfried Kracauer, 'Cult of Distraction', in his *The Mass Ornament: Weimar Essays*, ed. Tom Levin (Cambridge, MA, 1995), p. 324.
- 94 Siegfried Kracauer, *Schriften* (Frankfurt am Main, 1990), vol. v, pt 1, pp. 338–42.
- 95 See Peter Jelavich, *Berlin Cabaret* (Cambridge, MA, 1993), p. 167.
- 96 This point is more familiar from his essay of 1931, 'Girls und Krise', where he speaks of 'artificially manufactured girls in the USA and exported one after the other to Europe'. See Kracauer, *Schriften*, vol. v, pt 2, p. 321.
- 97 Jelavich, *Berlin Cabaret*, p. 181.
- 98 Walter Benjamin, *Gesammelte Schriften*, vol. III (Frankfurt am Main, 1991), p. 227.
- 99 Ernst Bloch, *Erbschaft dieser Zeit* (Frankfurt am Main, 1985), pp. 33–5.
- 100 *Ibid.*, p. 60.
- 101 See Bloch, 'Künstliche Mitte', in *ibid.*, p. 33.
- 102 Siegfried Kracauer, 'Schrei auf der Strasse', in *Schriften*, vol. v, pt 2, p. 206.
- 103 Kracauer, *Schriften*, vol. v, pt 1, pp. 338–9.
- 104 *Ibid.*, pp. 300–308.
- 105 *Ibid.*, p. 303.
- 106 Kracauer, *Schriften*, vol. v, pt 2, pp. 200–201.
- 107 Siegfried Kracauer, 'Photography', in *The Mass Ornament*, pp. 47–63.
- 108 Kracauer, 'Cult of Distraction' in *ibid.*, p. 325.
- 109 Erich Mendelsohn, *Amerika* (New York, 1993), p. 54.
- 110 *Ibid.*, p. 52.
- 111 'Zu Eröffnung des "Universum"' (1928), Erich Mendelsohn, *Gedankenwelt: Unbekannte Texte zu Architektur, Kulturgeschichte und Politik* (Ostfildern-Ruit, 2000), p. 109.
- 112 *Ibid.*, p. 110.
- 113 Siegfried Kracauer, *The Salaried Masses: Duty and Distraction in Weimar Germany* (London, 1998), p. 93.
- 114 Kracauer, *Schriften*, vol. v, pt 1, p. 300.
- 115 Benjamin, *Gesammelte Schriften*, vol. III, p. 227.
- 116 Kracauer, *Schriften*, vol. v, pt 2, pp. 184–5.
- 117 See Matthew Luckiesh and Frank K. Moss, *The Science of Seeing* (London, 1937). This book comes with a cardboard insert to test visibility under different illuminations. It is called a 'visibility indicator', with words printed in black on an increasingly darkening panel, gridded out by 'relative foot-candles for equal ease of seeing'.
- 118 See A. Laing, *Lighting* (London, 1982). See also Wiebe E. Bijker, *Of Bicycles, Bakelites and Bulbs: Toward a Theory of Sociotechnical Change* (Cambridge, MA, 1997).
- 119 Kracauer, *Schriften*, vol. v, pt 1, p. 339.
- 120 Ernst Bloch, *Erbschaft dieser Zeit* (Frankfurt am Main, 1985), p. 217.

- 121 Kracauer, *Schriften*, vol. v, pt 2, p. 332.
- 122 Ibid., p. 334.
- 123 Kracauer, *Schriften*, vol. v, pt 1, pp. 308–12.
- 124 Ibid., pp. 296–300.
- 125 Ibid., pp. 296–7.
- 126 Ibid., p. 298.
- 127 Ibid., p. 299.
- 128 Ibid., p. 305.
- 129 Siegfried Kracauer, 'Travel and Dance', in *The Mass Ornament*, p. 66.
- 130 Kracauer, *Schriften*, vol. v, pt 1, p. 339.
- 131 Siegfried Kracauer, *Kino* (Frankfurt am Main, 1979), p. 50.
- 132 See Thomas Y. Levin, 'Introduction', in Kracauer, *The Mass Ornament*, pp. 7–8.

six

- 1 Friedrich Sieburg, 'Ein Jahrhundert Bayer Geschichte', *Revolution im Unsichtbaren* (Bayer, 1963).
- 2 See, among many other sources, James Joll, *Europe Since 1870: An International History* (Harmondsworth, 1990), p. 337.
- 3 See Bayer-Gefahren, ed., *IG Farben, von Anilin bis Zwangsarbeit: Zur Geschichte von BASF, Bayer, Hoechst und anderen deutschen Chemie-Konzernen* (Stuttgart, 1995), p. 53. See also Joseph Borkin, *The Crime and Punishment of IG Farben* (New York, 1978), p. 56, and Dieter Rebentisch, 'Frankfurt am Main und die Gründung der IG Farben', in *Der Poelzig-Bau, Vom IG Farben-Haus zur Goethe-Universität*, ed. Werner Meissner (Frankfurt am Main, 1999), p. 96.
- 4 Bayer-Gefahren, ed., *IG Farben*, p. 54.
- 5 Ibid., p. 53.
- 6 On the relationship of IG Farben and the NSDAP in the early days of the regime, see Rebentisch, 'Frankfurt am Main', pp. 93–6.
- 7 Cited in Helga Krohn et al., *Geschichte der Farbwerke Hoechst und der chemischen Industrie Deutschland* (Offenbach, 1989), p. 78.
- 8 Despite these and other close ties, Tim Mason, Peter Hayes and others assert 'the primacy of politics', whereby the economic interests of firms such as IG Farben had little effect on policy. See, for example, 'Der Primat der Politik' in *Das Argument*, no. 41 (West Berlin, 1966); trans. and rev. as 'The Primacy of Politics' in *The Nature of Fascism*, ed. S. J. Woolf (London, 1968); Peter Hayes, 'Die IG Farbenindustrie als nationalsozialistischer Staatskonzern', in *Der Poelzig-Bau*, pp. 97–103. In this context, incidentally, IG Farben benefited economically from Nazi policy because its fields, along with building and engineering, were supported by a war-oriented policy. See Tim Mason, 'The Primacy of Politics', in *The Nature of Fascism*, pp. 185–7.
- 9 Frank A. Howard, *Buna Rubber: The Birth of an Industry* (New York, 1947), p. 3.
- 10 Anon., *Erzeugnisse unserer Arbeit* (Frankfurt am Main, 1938), p. 7. Responsible for the organization of this new Mayday was Robert Ley, the leader of Deutsche Arbeitsfront. Ley was a former chemist at IG Farben.
- 11 Ibid., pp. 8–11.
- 12 Ibid., p. 24.
- 13 Ibid., pp. 24–5.
- 14 This writer later promoted von Däniken and ran Econ-Verlag.
- 15 E. Barth von Wehrenalp, *Farbe aus Kohle* (Stuttgart, 1937), p. 5.
- 16 Ibid., p. 44.
- 17 Ibid., p. 33.
- 18 Ibid., p. 34.
- 19 Ibid., p. 33.
- 20 Ibid., p. 32.
- 21 Walter Greiling, *Chemie Erobert die Welt* (Berlin, 1943), p. 119.
- 22 Ibid., p. 121.
- 23 Ibid., p. 3.
- 24 Ibid., p. 274.
- 25 Ibid., pp. 324–6.
- 26 Ibid., p. 332.
- 27 Ibid., p. 340.
- 28 Ibid., p. 341.
- 29 Ibid., p. 342.
- 30 Post-war editions were revised to omit politically embarrassing aspects.
- 31 Karl Aloys Schenzinger, *Anilin* (Berlin, 1938).

- 32 Bertold Aunft, *Friedlieb Ferdinand Runge: Sein Leben und Sein Werk* (Berlin, 1937).
- 33 Ibid., p. 45.
- 34 Ibid., p. 125.
- 35 Ibid., p. 31.
- 36 Benjamin's introduction to a letter exchange between Liebig and the poet and dramatist Count August von Platen Hallermund also notes that the close ties between scientists and literature were on their way to being broken. Wistfully, of Liebig, he notes: 'Thus in his early life and in his old age, he represented that generation of scientists for whom philosophy and poetry were not quite lost to view, even when "they appeared only as ghostly forms beckoning through the mist"'. Walter Benjamin, *Selected Writings*, vol. III: 1935–1938 (Cambridge, MA, 2002), p. 196.
- 37 See Walter Benjamin, *Selected Writings*, vol. IV: 1938–1940 (Cambridge, MA, 2003).
- 38 Anon., *Erzeugnisse unserer Arbeit*, p. 58.
- 39 Ibid.
- 40 Hans Dominik, *Vistra: das weisse Gold Deutschlands* (Leipzig, 1936).
- 41 Anon., *Erzeugnisse unserer Arbeit*, p. 187.
- 42 Ibid.
- 43 Ibid., p. 189.
- 44 Nissen provides no sources (nor is information about his identity available), so the veracity of his claims is difficult to ascertain. It may be 'black' propaganda, but many of the claims are plausible.
- 45 Olaf Nissen, *Germany: Land of Substitutes* (London, 1944), book jacket.
- 46 Ibid., foreword.
- 47 Ibid., p. 3.
- 48 Ibid., p. 131.
- 49 Ibid., p. 148.
- 50 Ibid., pp. 132–3.
- 51 Ibid., p. 97.
- 52 Ibid., p. 11.
- 53 Ibid., p. 99.
- 54 Ibid., p. 99.
- 55 Ibid., p. 100.
- 56 Ibid., p. 42.
- 57 Ibid., pp. 31–2.
- 58 Ibid., p. 91.
- 59 Ibid., pp. 85–6.
- 60 Ibid., p. 160.
- 61 Ibid., p. 17.
- 62 Ibid., p. 126.
- 63 Ibid., pp. 125–6.
- 64 Ibid., p. 127.
- 65 Ibid., p. 123.
- 66 Ibid., p. 124.
- 67 Ibid.
- 68 Ibid., p. 125.
- 69 This was never achieved so perfectly that they become as indestructible as the white suit in the Ealing film comedy of 1951, against which workers and bosses unite in fear for their jobs and their profits. This was not a complete fantasy. For example, when indanthrene colours were invented in Germany at the beginning of the twentieth century, dyers struck against the use of these permanent colours.
- 70 Nissen, *Germany*, pp. 118–19.
- 71 T. W. Adorno and Max Horkheimer, *Dialectic of Enlightenment* (1944) (London, 1995), pp. 232–3.
- 72 See *ibid.*, p. 253.
- 73 See Donny Gluckstein, *The Nazis, Capitalism and the Working Class* (London, 1999), p. 168.
- 74 Borkin, *Crime and Punishment of IG Farben*, p. 97.
- 75 Bayer-Gefahren, ed., *IG Farben*, p. 58.
- 76 Ibid., p. 49.
- 77 T. W. Adorno, *Minima Moralia: Reflections from Damaged Life* (London, 1978), p. 51.
- 78 See Max Weinreich, *Hitler's Professors: The Part of Scholarship in Germany's Crimes Against the Jewish People* (1946) (New Haven and London, 1999).
- 79 These details stem from the Franke-Gricksch report on Auschwitz, in May 1943, when the ss Sturmabführer undertook a trip through the general gouvernement. It is reproduced in Jean Claude Pressac, *Auschwitz: Technique and Operation of the Gas Chambers* (New York, 1989), pp. 238–9.
- 80 This translates as the German Company for Pest Control. Degesch was founded in 1917 by the German War Ministry's Technical Committee for Pest Control.

- 81 Bayer-Gefahren, ed., *IG Farben*, p. 100.
- 82 Raul Hilberg, *The Destruction of European Jews* (New York, 1985), p. 888.
- 83 See Jean Claude Pressac, *Auschwitz: Technique and Operation of the Gas Chambers* (New York, 1989), pp. 17 and 93.
- 84 Bayer-Gefahren, ed., *IG Farben*, p. 76.
- 85 Ibid., p. 78.
- 86 Money did exist in some camps, produced by the prisoners, but it was not a payment for work, for the workers were slave-labourers. It was a 'reward' for good behaviour. In Sachsenhausen concentration camp another type of fake money existed. Prisoners successfully faked the Allies' money in the 1940s, leading to panic on the part of the Bank of England.
- 87 Bayer-Gefahren, ed., *IG Farben*, p. 83.
- 88 Hilberg, *Destruction of European Jews*, p. 929. See also Bayer-Gefahren, ed., *IG Farben*, p. 85.
- 89 See Borkin, *Crime and Punishment of IG Farben*, p. 113. Borkin cites the testimony of an inmate worker.
- 90 See Weinreich, *Hitler's Professors*, pp. 199–200.
- 91 Ibid., p. 200.
- 92 Adorno, *Minima Moralia*, pp. 152–5.
- 93 Ibid., p. 152.
- 94 Ibid., p. 154.
- 95 Ibid., p. 155.
- 96 Ibid.
- 97 Ibid.
- 98 Ibid., p. 154.
- 99 See Clement Greenberg's argument in 'Avant-Garde and Kitsch', written in 1939 (anthologized variously).
- 100 The speech is excerpted in Stephanie Barron, ed., *Degenerate Art: The Fate of the Avant Garde in Germany* (Los Angeles, 1991), pp. 386–8.

seven

- 1 Oskar Schlemmer, *The Letters and Diaries* (Middletown, CT, 1972), p. 311.
- 2 See Schlemmer's letter to Willi Baumeister, 2 April 1933, in *ibid.*, p. 309.
- 3 Ibid.
- 4 See Peter Boswell and Maria Makela, eds, *The Photomontages of Hannah Höch*, exh. cat., Walker Art Center, Minneapolis, MN (1997), p. 197.
- 5 For further discussion of the *Degenerate Art Exhibition* and the practices of Höch and Baumeister, see my essay 'Philistines and Art Vandals Get Upset' in *The Philistine Controversy*, ed. Dave Beech and John Roberts (London, 2002), pp. 201–27, where some of this material took its first form.
- 6 See Schlemmer's letter of 24 May 1938, in *Letters and Diaries*, p. 371.
- 7 See Schlemmer's letter of 22 June 1940, in *ibid.*, p. 381.
- 8 Reproduced in Kurt Herberts, ed., *Modulation und Patina: Ein Dokument aus dem Wuppertaler Arbeitskreis um Willi Baumeister, Oskar Schlemmer, Franz Krause, 1937–1944* (Stuttgart, 1989), p. 19.
- 9 The reference is to the nature researcher Ernst Haeckel.
- 10 Reproduced in Herberts, ed., *Modulation und Patina*, p. 19.
- 11 Schlemmer, *Letters and Diaries*, pp. 389–90.
- 12 Ibid., pp. 400–401.
- 13 Tim Mason's analyses recorded opposition and spontaneous struggles in the Third Reich. These were usually part of efforts to safeguard workers' economic interests. Political resistance was punishable by imprisonment and death, but it did not disappear, despite all the Nazis' efforts, even inside the concentration camps. See Tim Mason, *Nazism, Fascism and the Working Class* (Cambridge, 1995) and Mason, *Social Policy in the Third Reich: The Working Class and the 'National Community', 1918–1939* (Oxford, 1993).
- 14 Herberts, ed., *Modulation und Patina*, p. 66.
- 15 *Minotaure*, no. 8 (Paris, 1936).
- 16 Herberts, ed., *Modulation und Patina*, p. 149.
- 17 *Focus on Minotaure: The Animal-Headed Review*, exh. cat., Musée d'Art et d'Histoire, Geneva, 1987.
- 18 *Minotaure*, no. 8, p. 18.
- 19 Herberts, ed., *Modulation und Patina*, p. 224.
- 20 Ibid., p. 24.
- 21 See Clement Greenberg, 'Avant-Garde and Kitsch', *Art in Theory* (Oxford, 1992), p. 539.
- 22 Hitler, extracts of speech on the opening of the House of German Art, reproduced in the *Degenerate Art* brochure under the title 'An End to Art-Bolshevism', reprinted in Stephanie Barron, ed., *Degenerate Art: The Fate of the Avant Garde in Germany* (Los Angeles, 1991), p. 384.
- 23 See Peter Chametsky, 'Marginal Comments, Opposition Work: Willi Baumeister's Confrontation with

- Nazi Art', in *Willi Baumeister: Zeichnungen, Gouachen, Collagen*, exh. cat. (Stuttgart, 1989), p. 251.
- 24 See René Hirner, 'Anmerkungen zu Willi Baumeisters Hinwendung zum Archaischen', in *Willi Baumeister*, pp. 47–8.
- 25 See Frank Wagner and Gudrun Linke's discussion of state sculpture, 'Mächtige Körper', in *Insenierung der Macht: Ästhetische Faszination im Faschismus*, pp. 63–78.
- 26 This is according to his testimony in 1950, cited in Hellmut Lehmann-Haupt's *Art Under a Dictatorship*. See Barron, *Degenerate Art*, p. 201.
- 27 Herberts, ed., *Modulation und Patina*, p. 29.
- 28 *Ibid.*, p. 72.
- 29 Hans Hildebrandt, quoted in *ibid.*, p. 222.
- 30 Herberts, ed., *Modulation und Patina*, p. 72.
- 31 *Ibid.*, pp. 222–4.
- 32 *Ibid.*, p. 64.
- 33 *Ibid.*, p. 68.
- 34 *Ibid.*, p. 224.
- 35 *Ibid.*, p. 42.
- 36 *Ibid.*
- 37 *Ibid.*, p. 40.
- 38 *Ibid.*, p. 138.
- 39 For Adorno's critical but sympathetic analysis of the return of the *Kulturlandschaft*, see Theodor W. Adorno, *Aesthetic Theory* (London, 1984), pp. 94–7. In German, Adorno, *Ästhetische Theorie*, in *Gesammelte Schriften*, vol. vii (Frankfurt am Main, 1986), pp. 101–2.
- 40 Schopenhauer is quoted in Herberts, ed., *Modulation und Patina*, p. 231.
- 41 Novalis, *The Disciples at Sais and Other Fragments* (London, 1903), p. 91. This passage is quoted in Herberts, ed., *Modulation und Patina*, pp. 142–3.
- 42 Herberts, ed., *Modulation und Patina*, p. 143.
- 43 Adorno remarks on this development in Adorno, *Aesthetic Theory*, p. 104. In German, Adorno, *Ästhetische Theorie*, in *Gesammelte Schriften*, vol. vii, p. 110.
- 44 J. W. Goethe, *Theory of Colours* (Cambridge, MA, 1970), pp. 34–5.
- 45 For an illustrated description of Camp Dora and its work, see Yves Le Maner and André Sellier, *Bilder aus Dora: Zwangsarbeit im Raketentunnel, 1943–1945* (Bad Münstereifel, 2001).
- 46 The materials found their way back to Wuppertal in 1947.
- 47 Oskar Schlemmer died in 1943. Some of the artists resumed their artistic practice, abandoning the scientific-technological context and the collective aspect. Willi Baumeister became a leading representative of German post-war abstraction before his death in 1955.
- 48 The post-war fate of Herberts & Co. is as follows. It grew and grew, and in 1972 Hoechst AG purchased 51 per cent of the company from the Herberts family. In 1976 Hoechst acquired the remaining shares. In the late 1990s Hoechst sold Industrial Coatings, its subsidiary company, now a vast concern, to DuPont Performance Coatings.
- 49 Drawing on research by Martin Weinmann, Ursula Krause-Schmitt and Anne Kaiser in *Das national-sozialistische Lagersystem* (Frankfurt am Main, 1990); this list was reprinted in the newspaper *Neues Deutschland*, 16 November 1999.
- 50 See Helga Krohn *et al.*, *Geschichte der Farbwerke Hoechst und der chemischen Industrie Deutschland* (Offenbach, 1989), p. 117.
- 51 Karl Heinz Roth, 'Introduction', in *Ermittlungen gegen die IG Farbenindustrie AG, September 1945*, ed. O.M.G.U.S (Nördlingen, 1986), p. xxvi.
- 52 Krohn *et al.*, *Geschichte der Farbwerke Hoechst*, p. 125.
- 53 A number of them later received honours in the Federal Republic of Germany
- 54 Richard Sasuly, *IG Farben* (New York, 1947), p. 216. Sasuly's book had a curious afterlife. Thomas Pynchon quoted passages from it virtually word for word in his novel of 1973, *Gravity's Rainbow*.
- 55 Sasuly, *IG Farben*, p. 12.
- 56 *Ibid.*, p. v.
- 57 *Ibid.*, p. x.
- 58 K. A. Schenzinger, *Bei IG Farben, Ein Roman* (Munich, 1953), p. 320.
- 59 *Ibid.*, pp. 378–80.
- 60 James Burnham, *The Struggle for the World* (London, 1947), p. 9.
- 61 *Ibid.*, p. 249.
- 62 James Burnham, *The War We Are In: The Last Decade and the Next* (New York, 1967), p. 10.

- 1 Marc Eliot, *Walt Disney, Hollywood's Dark Prince* (London, 1994), p. 267.
- 2 A coinage attributed variously to George Orwell (1945), Winston Churchill (1946) and Bernard Baruch (1947).
- 3 Robert C. W. Ettinger, *The Prospect of Immortality* (London, 1965), p. 180.
- 4 *Ibid.*, p. 1.
- 5 *Ibid.*, p. 170.
- 6 *Ibid.*, p. 171.
- 7 *Ibid.*, p. 175.
- 8 At the beginning of the twenty-first century, cryonicists claimed to have solved this problem, eliminating ice-crystal formation by cooling body substances to form a glass through 'vitrification'. The molecules remain disorderly, as in a fluid, rather than forming organized crystalline patterns.
- 9 See Max Weinreich, *Hitler's Professors: The Part of Scholarship in Germany's Crimes Against the Jewish People* (1946; New Haven and London, 1999), p. 195.
- 10 Situationist materials can be readily found online in various places and are anti-copyright.
- 11 Guy Debord, *Society of the Spectacle*, thesis 130.
- 12 *Ibid.*, thesis 142.
- 13 *Ibid.*, thesis 145.
- 14 *Ibid.*, thesis 150.
- 15 *Ibid.*, thesis 170.
- 16 *Ibid.*, thesis 200.
- 17 *Ibid.*, thesis 201.
- 18 *Ibid.*, thesis 21.
- 19 Raoul Vaneigem, 'Roles', in *The Revolution of Everyday Life* (1967). Available online.
- 20 Debord, *Society of the Spectacle*, thesis 206.
- 21 *Ibid.*, thesis 214.
- 22 As Debord put it in 'Definitions' in the first *SI* journal in 1958.
- 23 As Eldridge Cleaver called them.
- 24 Were the Watts Riots linked to Disney in any way? In his final television appearance, in December 1966, Walt Disney declared that urban problems were the major social problems of the day. Riots were one manifestation. In 1965 civil rights demonstrations targeted the New York World's Fair where Disney made audio-animatronic exhibits for Pepsi Cola, General Electric, Ford Motor Company and the Illinois pavilion. In November 1966 President Lyndon Johnson signed the 'Demonstration Cities and Metropolitan Development Act ("Model Cities")'. Regeneration of cities, especially slum districts, was the remedy for urban unrest, and financial and technical assistance was offered to develop 'new and imaginative proposals'. Disney, who had reinvented the amusement park as Disneyland's family-friendly wholesome environment, hoped to pioneer the conversion of dilapidated cities into decontaminated, neighbourly towns in his EPCOT project. See Steve Mannheim, *Walt Disney and the Quest For Community* (Aldershot, 2002).
- 25 'The Revolution of Modern Art and the Modern Art of Revolution', available online.
- 26 See, for example, T. W. Adorno, *Negative Dialectics* (London, 1973), pp. 68, 163. In German, Adorno, *Negative Dialektik*, in *Gesammelte Schriften*, vol. vi (Frankfurt am Main, 1986), pp. 75, 165.
- 27 Adorno, *Negative Dialectics*, p. 206 (translation modified). In German, in *Gesammelte Schriften*, vol. vi, p. 206.
- 28 Adorno, *Negative Dialectics*, p. 363. In German, in *Gesammelte Schriften*, vol. vi, p. 356.
- 29 Walter Benjamin, 'Der Autor als Produzent' (1934), in *Gesammelte Schriften*, vol. ii, pt 2, (Frankfurt am Main, 1991), p. 699. In English, Walter Benjamin, *Selected Writings*, vol. ii: 1927–1934 (Cambridge, MA, 1999), p. 779.
- 30 Adorno, *Negative Dialectics*, p. 363 (translation modified). In German, in *Gesammelte Schriften*, vol. vi, p. 356.
- 31 See, for example, *Grimm's Fairy Tales*, trans. L. L. Weedon, illustrated by Ada Dennis *et al.* (London, 1898).
- 32 Adorno, *Negative Dialectics*, p. 347 (translation modified). In German, in *Gesammelte Schriften*, vol. vi, p. 340.
- 33 See Adorno, *Aesthetic Theory* (London, 1984), p. 429. In German, Adorno, *Ästhetische Theorie: Paralipomena*, in *Gesammelte Schriften*, vol. vii (Frankfurt am Main, 1986), p. 460.
- 34 Adorno, *Aesthetic Theory*, p. 82. In German, Adorno, *Gesammelte Schriften*, vol. vii, p. 89.
- 35 Walter Benjamin, *Gesammelte Schriften*, vol. ii, pt 1 (Frankfurt am Main, 1991), p. 378. In English, Benjamin, *Selected Writings*, vol. ii, pp. 518–19. This definition of aura is repeated in modified but comparable form in 1935 in the 'Artwork essay' and in writings on Baudelaire in 1938.
- 36 For Benjamin, the body breathing was long a figure of thinking. This essential breath connects to thought itself. As Benjamin notes in *The Origin of German Mourning Play*: 'The act of thinking constantly starts anew, it takes the time to go back to the matter itself. This unending breathing is the proper form of exis-

- tence of contemplation'. Benjamin, *Gesammelte Schriften*, vol. 1, pt 1 (Frankfurt am Main, 1991), p. 208.
- 37 Prynne's poems are collected in J. H. Prynne, *Poems* (Newcastle upon Tyne / South Fremantle, 2005).
- 38 See N. H. Reeve and Richard Kerridge, *Nearly Too Much: The Poetry of J. H. Prynne* (Liverpool, 1995), p. 80.
- 39 Prynne, *Poems*, pp. 127–32.
- 40 See Ralph Rumney, *The Consul* (London, 2002), p. 40.
- 41 Christopher Gray, *Leaving the Twentieth Century* (London, 1974), p. 1.
- 42 See Ian Patterson, "'The Medium Itself, Rabbit by Proxy': Some Thoughts about Reading J. H. Prynne," in *Poets on Writing: Britain, 1970–1991*, ed. Denise Riley (Basingstoke, 1992), p. 243.
- 43 *Aesthetic Theory* appeared posthumously in 1970.
- 44 Adorno, *Aesthetic Theory*, p. 58 (translation modified). In German in *Gesammelte Schriften*, vol. vii, p. 65.
- 45 Adorno, *Aesthetic Theory*, p. 196. In German in *Gesammelte Schriften*, vol. vii, p. 204.
- 46 Theodor W. Adorno, 'Bibliographische Grillen', in *Gesammelte Schriften*, vol. xi (Frankfurt am Main, 1986), p. 345.
- 47 See Walter Benjamin's short essay 'The Rainbow' (1914–15) in Benjamin, *Gesammelte Schriften*, vol. vii, pt 1 (Frankfurt am Main, 1991), pp. 19–26. See also my discussion of this essay in the chapter 'Techne-Colour' in Esther Leslie, *Hollywood Flatlands: Animation, Critical Theory and the Avant-Garde* (London, 2002).
- 48 Chemistry sets as such first came into being in the late eighteenth century. They were used by pharmacists and medical students, but also were used as toys for amusement and edification of the wealthy. Before the chemistry set there were instructional books, such as seventeenth-century European books on natural magick, which included chemical magic tricks.
- 49 Olaf Nissen's *Germany: Land of Substitutes* (London, 1944) reports on these developments.
- 50 Vogel carried out research for IBM, for which he helped to develop a magnetic coating for hard disks, a substance made of two seemingly incompatible chemical agents that reputedly came to him in a dream. He sold his company, in order to work full-time for IBM, where he filed patents in the field of magnetic recording media, liquid crystals and rare earth phosphors. Some initially sceptical experimental work on the 'emotions' of plants led him to metaphysics. He decided that thought was a transferable bio-energetic force. He researched the healing forces of crystals. The name crystal means 'frozen light': some believe the crystal to be light stepped down through numerous levels of density. Vogel invented modes of cutting crystals to harness their energy for healing effects.
- 51 IG Farbenindustrie AG i. L. (in liquidation) was formed with the sole purpose of satisfying outstanding claims from creditors and injured parties. This company was declared bankrupt in 2003.
- 52 These claims stem from Day-Glo Color Corp.'s promotional materials.
- 53 Roland Barthes, 'Plastic', *Mythologies* (1957) (London, 1973), pp. 104–6.
- 54 See Theodor W. Adorno, 'Bibliographische Grillen', in *Gesammelte Schriften*, vol. xi, p. 349.
- 55 Pamela Zoline, 'The Heat Death of the Universe' is anthologized widely. It can be found in Brian W. Aldiss and Harry Harrison, eds, *Decade: The 1960s* (London, 1977).
- 56 Presumably this refers to *Girl on a Motorcycle*.
- 57 X-Ray Spex, 'Art-i-Ficial', *Germ-free Adolescence* (EMI, 1978).
- 58 Jamie Reid, *The Incomplete Works of Jamie Reid* (London, 1987), p. 79.
- 59 Chris Brook, ed., *K Foundation Burn A Million Quid* (London, 1997), p. 18.
- 60 Karl Marx, 'Economic and Philosophical Manuscripts', *Early Writings* (Harmondsworth, 1977), p. 377.
- 61 Iain Sinclair and Emma Matthews, *White Goods* (Uppingham, 2002), p. 20.
- 62 The plan was to replace it later by a 'snowdome' with real snow.
- 63 Iain Sinclair, *London Orbital* (London, 2002), p. 82.
- 64 See, for example, *ibid.*, pp. 39–40.
- 65 *Ibid.*, pp. 51–4.
- 66 Iain Sinclair and Emma Matthews, *White Goods* (Uppingham, 2002), p. 22.
- 67 Sinclair, *London Orbital*, p. 120.
- 68 Iain Sinclair, *Lights Out For the Territory* (London, 1998), p. 216.
- 69 Since 1991 its owners are RPM, Inc., producer of coatings, sealants and speciality chemicals.
- 70 Quoted from promotional material published by Day-Glo Color Corp.

conclusion

- 1 See Walter Benjamin, *Gesammelte Schriften*, vol. vi (Frankfurt am Main, 1991), pp. 147–8.
- 2 As stated on LifeGem's UK website in February 2004.

Select Bibliography

- Theodor W. Adorno, *Negative Dialectics* (London, 1973)
- , *Minima Moralia: Reflections from Damaged Life* (London, 1978)
- , *Aesthetic Theory* (London, 1984)
- , *Gesammelte Schriften* (Frankfurt am Main, 1986)
- Theodor W. Adorno and Max Horkheimer, *Dialectic of Enlightenment* (1944) (London, 1995)
- Brian W. Aldiss and Harry Harrison, eds, *Decade: The 1960s* (London, 1977)
- Bertold Auerbach, *Friedrich Ferdinand Runge: Sein Leben und Sein Werk* (Berlin, 1937)
- Andrej Anikin, *Gold* (Berlin, 1980)
- Anon., *Erzeugnisse unserer Arbeit* (Frankfurt am Main, 1938)
- Stephanie Barron, ed., *Degenerate Art: The Fate of the Avant Garde in Germany* (Los Angeles, 1991)
- Roland Barthes, *Mythologies* (1957) (London, 1973)
- Bayer-Gefahren, ed., *IG Farben, von Anilin bis Zwangsarbeit: Zur Geschichte von BASF, Bayer, Hoechst und anderen deutschen Chemie-Konzernen* (Stuttgart, 1995)
- Michael Baxandall, *Painting and Experience in Fifteenth Century Italy* (Oxford, 1988)
- John Bellamy Foster, *Marx's Ecology: Materialism and Nature* (New York, 2002)
- Walter Benjamin, *Briefe*, 2 vols (Frankfurt am Main, 1978)
- , *Selected Writings*, vol. I: 1913–1926 (Cambridge, MA, 1996)
- , *Selected Writings*, vol. II: 1927–1934 (Cambridge, MA, 1999)
- , *Selected Writings*, vol. III: 1935–1938 (Cambridge, MA, 2002)
- , *Selected Writings*, vol. IV: 1938–1940 (Cambridge, MA, 2003)
- , *The Arcades Project* (Cambridge, MA, 1999)
- John Desmond Bernal, 'The Flesh', in *The World, the Flesh and the Devil: An Enquiry into the Future of the Three Enemies of the Rational Soul* (London, 1929)
- F. J. Bertuch, *Über die Mittel Naturgeschichte gemeinnütziger zu machen und in das praktische Leben einzuführen* (Weimar, 1799)
- Wiebe E. Bijker, *Of Bicycles, Bakelites and Bulbs: Toward a Theory of Sociotechnical Change* (Cambridge, MA, 1997)
- Gustav Bischof, *Populäre Briefe an eine gebildete Dame über die gesammten Gebiete der Naturwissenschaften* (Pforzheim, 1848)
- Blast: Review of the Great English Vortex* (London, 1914)
- Blast: War Issue* (London, 1915)
- Ernst Bloch, *Erbschaft dieser Zeit* (Frankfurt am Main, 1985)
- Joseph Borkin, *The Crime and Punishment of IG Farben* (New York, 1978)
- Peter Boswell and Maria Makela, eds, *The Photomontages of Hannah Höch*, exh. cat., Walker Art Center, Minneapolis, MN (1997)
- Robert Boyle, *Occasional Reflections upon several subjects whereto is premis'd a discourse about such kind of thoughts* (London, 1665)
- André Breton, *Nadja* (1928) (Paris, 1964)
- , *The Second Manifesto of Surrealism* (1930), in his *Manifestos of Surrealism* (Ann Arbor, MI, 1972)
- Chris Brook, ed., *K Foundation Burn A Million Quid* (London, 1997)
- Franco Brunello, *The Art of Dyeing in the History of Mankind* (Venice, 1973)
- N. I. Bukharin et al., *Marxism and Modern Thought* (London, 1935)

- James Burnham, *The Struggle For the World* (London, 1947)
- Bozena Cholu, *Deutsche Schriftsteller im Banne der Novemberrevolution 1918* (Wiesbaden, 1991)
- A. Clarke, *Coal Tar Colours in the Decorative Industries* (London, 1922)
- Richard Cork, *Vorticism and Abstract Art in the First Machine Age*, vol. 1: *Origins and Developments* (London, 1976)
- Hans Dominik, *Vistra - das weisse Gold Deutschlands* (Leipzig, 1936)
- Walter Dornberger, *Peenemünde: Die Geschichte der V-Waffen* (Berlin, 2003)
- Carl Duisberg, *Abhandlungen, Vorträge und Reden aus den Jahren 1923–1933* (Berlin, 1933)
- Bob Edwards, *Chemicals: Servant or Master? Life or Death?*, (London, 1947)
- Marc Eliot, *Walt Disney, Hollywood's Dark Prince* (London, 1994)
- Friedrich Engels, *The Condition of the Working Classes in England* (1844) (London, 1936)
- , *Ludwig Feuerbach and the Outcome of Classical German Philosophy* (1888) (London, 1941)
- Robert C. W. Ettinger, *The Prospect of Immortality* (London, 1965)
- Gerald D. Feldman, *The Great Disorder: Politics, Economics, and Society in the German Inflation, 1914–1924* (Oxford, 1997)
- Ludwig Feuerbach, *The Essence of Christianity*, 2nd edn, trans. Marian Evans (London, 1881)
- Focus on Minotaure: The Animal-Headed Review*, exh. cat., Musée d'Art et d'Histoire (Geneva, 1987)
- Donny Gluckstein, *The Nazis, Capitalism and the Working Class* (London, 1999)
- J. W. Goethe, *Theory of Colours*, trans. Charles Lock Eastlake (Cambridge, MA, 1970)
- , *Werke in 14 Bänden*, 9th edn, vol. xiii (Hamburg, 1981)
- , *Faust 1 & II*, vol. II: *The Collected Works*, ed. and trans. Stuart Atkins (Princeton, NJ, 1994)
- Christopher Gray, ed., *Leaving the Twentieth Century* (London, 1974)
- Walter Greiling, *Chemie Erobert die Welt* (Berlin, 1943)
- Grimm brothers, *Grimm's Fairy Tales*, trans. L. L. Weedon, illustrated by Ada Dennis *et al.* (London, 1898)
- Otto-Joachim Grüsser, *Justinus Kerner, 1786–1862: Arzt, Poet, Geisterseher* (Heidelberg, 1987)
- Erich Haeckel, *Riddle of the Universe* (New York, 1992)
- Chris Harman, *The Lost Revolution: Germany, 1918–1923* (London, 1982)
- Charles Harrison and Paul Wood, *Art In Theory, 1900–1990* (Oxford, 1992)
- G.W.F. Hegel, *Lectures on the History of Philosophy* (1805–17) (London, 1896)
- , *Philosophy of Nature*, vol. III, ed. and trans. M. J. Petry (London, 1970)
- Martin Heidegger, *Basic Writings* (London, 1977)
- Agnes Heller, ed., *Lukács Revalued* (Oxford, 1983)
- Holly Henry, *Virginia Woolf and the Discourse of Science: The Aesthetics of Astronomy* (Cambridge, 2003)
- Kurt Herberts, ed., *Modulation und Patina: Ein Dokument aus dem Wuppertaler Arbeitskreis um Willi Baumeister*, Oskar Schlemmer, Franz Krause, 1937–1944, exh. cat. (Stuttgart, 1989)
- Raul Hilberg, *The Destruction of European Jews* (New York, 1985)
- Hoechst Aktiengesellschaft, *Farb Werke: Historische Etiketten* (Frankfurt am Main, 1985)
- E. T. A. Hoffmann, *Hoffmanns Werke*, vol. II (Leipzig, 1896)
- Max Horkheimer, 'The Jews and Europe' (1939), in *Critical Theory and Society: A Reader*, ed. Stephen Bronner and Douglas Kellner (New York, 1989)
- Frank A. Howard, *Buna Rubber: The Birth of an Industry* (New York, 1947)
- Kathleen James, *Erich Mendelsohn and the Architecture of German Modernism* (Cambridge, 1997)
- Peter Jelavich, *Berlin Cabaret* (Cambridge, MA, 1993)
- James Joll, *Europe Since 1870: An International History* (Harmondsworth, 1990)
- Franz Jung, *Die Eroberung der Maschinen* (Berlin, 1923)
- , *Der Weg nach Unten* (1961) (Hamburg, 1988)
- Ernst Jünger, *In Stahlgewittern: Aus dem Tagebuch eines Stosstruppführers* (Berlin, 1922)
- Anton Kaes, Martin Jay and Edward Dimendberg, eds, *The Weimar Republic Sourcebook* (Berkeley, CA, 1994)
- Karl Kraus, exh. cat. (Marbach am Neckar, 1999)
- Siegfried Kracauer, *Schriften* 5, vol. V (Frankfurt am Main, 1990)
- , *The Mass Ornament: Weimar Essays* (Cambridge, MA, 1995)
- , *The Salaried Masses: Duty and Distraction in Weimar Germany* (London, 1998)
- Helga Krohn *et al.* *Geschichte der Farbwerke Hoechst und der chemischen Industrie Deutschland* (Offenbach, 1989)
- A. Laing, *Lighting* (London, 1982)
- Yves Le Maner and André Sellier, *Bilder aus Dora: Zwangsarbeit im Raketentunnel, 1943–1945* (Bad Münstereifel, 2001)
- V. I. Lenin, 'The Importance of Gold Now and After the Complete Victory of Socialism' (1921), in *Collected Works*, vol. xxxiii (Moscow, 1965)
- , *Materialism and Empirio-criticism* (1908) (Beijing, 1972)
- Esther Leslie, *Hollywood Flatlands: Animation, Critical Theory and the Avant-Garde* (London, 2002)

- Wyndham Lewis, *Blasting and Bombardiering* (1937) (London, 1967)
- , *Rude Assignment: An Intellectual Autobiography* (1950) (Santa Barbara, CA, 1984)
- Justus von Liebig, *Letters on the Subject of the Utilization of the Municipal Sewage* (1865) (London, 1865)
- John Locke, 'Further Considerations Concerning Raising the Value of Money', in *Essays* (London, 1883)
- Matthew Luckiesh and Frank K. Moss, *The Science of Seeing* (London, 1937)
- Georg Lukács, *A Defence of History and Class Consciousness: Tailism and the Dialectic*, trans. Esther Leslie (London, 2000)
- Steve Mannheim, *Walt Disney and the Quest For Community* (Aldershot, 2002)
- Karl Marx, *Capital*, vol. 1 (New York, 1906)
- , *Capital*, vol. III (Moscow, 1971)
- , *Grundrisse: Foundations of the Critique of Political Economy* (1857–8) (Harmondsworth, 1973)
- , *Collected Works*, vol. 1 (London, 1975)
- , *Early Writings* (London, 1975)
- , *A Contribution to the Critique of Political Economy* (1859) (Moscow, 1977)
- , *The Eighteenth Brumaire of Louis Bonaparte* (1852) (London, 1984)
- Karl Marx and Friedrich Engels, *Correspondence of Marx and Engels: Selected Correspondence, 1846–1895* (London, 1941)
- , *The Holy Family; or, Critique of Critical Criticism* (1844) (Moscow, 1975)
- , *Collected Works*, vol. XXXIX (London, 1987)
- Tim Mason, *Social Policy in the Third Reich: The Working Class and the 'National Community', 1918–1939* (Oxford, 1993)
- , *Nazism, Fascism and the Working Class* (Cambridge, 1995)
- Werner Meissner et al., eds, *Der Poelzig-Bau, vom IG Farben-Haus zur Goethe-Universität* (Frankfurt am Main, 1999)
- Erich Mendelsohn, *Amerika* (New York, 1993)
- , *Gedankenwelt: Unbekannte Texte zu Architektur, Kulturgeschichte und Politik* (Ostfildern-Ruit, 2000)
- Minotaure*, no. 8 (Paris, 1936)
- Jeremy Naydler, ed., *Goethe on Science: An Anthology of Goethe's Scientific Writings* (Edinburgh, 1996)
- Michael Neary and Graham Taylor, 'Marx and the Magic of Money: Towards an Alchemy of Capital', in *Historical Materialism*, 2 (Summer 1998), pp. 99–117
- NGBK, ed., *Inszenierung der Macht: Ästhetische Faszination im Faschismus* (Nischen, 1987)
- Olaf Nissen, *Germany: Land of Substitutes* (London, 1944)
- Novalis (Friedrich von Hardenberg), *Henry of Ofterdingen* (1802, incomplete) (Cambridge, MA, 1842)
- , *The Disciples at Sais and Other Fragments* (1798), trans. F.V.M.T. and U.C.B. (London, 1903)
- Paul O'Keefe, *Some Sort of Genius: A Life of Wyndham Lewis* (London, 2000)
- Michael Opitz and Erdmut Wizisla, eds, *Benjamins Begriffe* (Frankfurt am Main, 2000)
- Peter Pachnicke and Klaus Honnef, eds, *John Heartfield* (New York, 1992)
- Robert Payne, *The Life and Death of Adolf Hitler* (New York, 1973)
- William Petty, 'Quantulumcunque Concerning Money' (1682), in *The Somers Collection of Tracts*, vol. VIII (London, 1812)
- Detlev Peukert, *Inside Nazi Germany: Conformity, Opposition and Racism in Everyday Life* (Harmondsworth, 1989)
- , *The Weimar Republic: The Crisis of Classical Modernity* (Harmondsworth, 1993)
- Lothar Pikulik, *Frühromantik: Epoche, Werke, Wirkung* (Munich, 1992)
- Edgar Allan Poe, *The Works of Edgar Allan Poe* (London, 1873)
- Jean Claude Pressac, *Auschwitz: Technique and Operation of the Gas Chambers* (New York, 1989)
- J. H. Prynne, 'Stars, Tigers and the Shape of Words', William Matthews Lecture, Birkbeck, University of London, 1993
- , *Poems* (Newcastle upon Tyne, South Fremantle, 2005)
- N. H. Reeve and Richard Kerridge, *Nearly Too Much: The Poetry of J. H. Prynne* (Liverpool, 1995)
- Jamie Reid, *The Incomplete Works of Jamie Reid* (London, 1987)
- Denise Riley, ed., *Poets on Writing: Britain, 1970–1991* (Basingstoke, 1992)
- Eberhard Roters, ed., *Stationen der Moderne* (Cologne, 1985)
- Karl Heinz Roth, 'Introduction', ed. O.M.G.U.S., *Ermittlungen gegen die IG Farbenindustrie AG, September 1945* (Nördlingen, 1986)
- Ralph Rumney, *The Consul* (London, 2002)
- F. F. Runge, *The Chemistry of Dyeing: The Art of Dyeing, Founded on the Chemical Relations of Cotton Thread to Salts and Acids* (London, 1837)
- , *Grundlehren der Chemie für Jedermann*, 3rd edn (Berlin, 1843)
- , *Grundriss der Chemie* (Munich, 1848)
- , *Zur Farben-Chemie: Musterbilder für Freunde des Schönen und zum Gebrauch für Zeichner, Maler, Verzierer und Zeugdrucker (dargestellt durch chemische Wechselwirkung)* (Berlin, 1850)

- , *Der Bildungstrieb der Stoffe, veranschaulicht in selbstständig gewachsenen Bildern (Fortsetzung der Musterbilder)* (Oranienburg, 1855)
- , *Hauswirthschaftliche Briefe* (1866) (Leipzig, 1988)
- Richard Sasuly, *IG Farben* (New York, 1947)
- Paul Scheerbart, *Immer Mutig!* (1902) (Frankfurt am Main, 1990)
- , *Münchhausen und Clarissa* (1906) (Hamburg, 1991)
- , *Glasarchitektur* (Berlin, 1914)
- F. W. Schelling, *Ideas For a Philosophy of Nature* (Cambridge, 1988)
- Karl Aloys Schenzinger, *Anilin* (Berlin, 1938)
- , *Bei IG Farben, Ein Roman* (Munich, 1953)
- Oskar Schlemmer, *The Letters and Diaries* (Middletown, CT, 1972)
- Eric Schlosser, *Fast Food Nation: What the All-American Meal is Doing to the World* (Harmondsworth, 2001)
- Anna Elisabeth Schreier and Manuela Wex, *Chronik der Hoechst Aktiengesellschaft, 1863–1998* (Frankfurt am Main, 1990)
- G. H. Schubert, *Ansichten von der Nachtseite der Naturwissenschaft* (Dresden, 1808)
- , *Die Symbolik des Traumes* (Bamberg, 1814)
- Mary Shelley, *Frankenstein; or, The Modern Prometheus* (Harmondsworth, 1985)
- Friedrich Sieburg, *Revolution im Unsichtbaren* (Bayer, 1963)
- Bernhard Siegert, *Relais: Geschehnisse der Literatur als Epoche der Post, 1751–1913* (Berlin, 1993)
- Iain Sinclair, *Lights Out For the Territory* (London, 1998)
- , *London Orbital* (London, 2002)
- Iain Sinclair and Emma Matthews, *White Goods* (Uppingham, 2002)
- Ann Taylor and Jane Taylor, *Rhymes for the Nursery* (London, 1814)
- Edward Timms, *Karl Kraus: Apocalyptic Satirist* (New Haven, 1989)
- Samuel Christoph Wagener, *Das Leben des Erdballs und aller Welten: Neue Ansichten und Folgerungen aus Thatsachen* (Berlin, 1828)
- Rose-Carol Washton-Long, ed., *German Expressionism: Documents from the End of the Wilhelmine Empire to the Rise of National Socialism* (New York, 1993)
- Ben Watson, *Art, Class and Cleavage: A Quantumuncunque Concerning Materialist Esthetix* (London, 1998)
- E. Barth von Wehrenalp, *Farbe aus Kohle* (Stuttgart, 1937)
- Max Weinreich, *Hitler's Professors: The Part of Scholarship in Germany's Crimes against The Jewish People* (1946) (New Haven and London, 1999)
- Gerhard Wietek, *Gemalte Künstlerpost: Karten und Briefe deutscher Künstler aus dem 20. Jahrhundert* (Munich, 1977).
- S. J. Woolf, ed., *The Nature of Fascism* (London, 1968)
- Theodore Ziolkowski, *German Romanticism and its Institutions* (Princeton, NJ, 1990)

Acknowledgements

The author and publishers wish to express their thanks to the following sources of illustrative material and/or permission to reproduce it (source or location details are in some cases also given below):

Collection of the author: 6, 13, 14, 22; reproduced with the kind permission of the Baumeister Archiv, Stuttgart: 17, 18, 19, 20, 21, 22, 23, 28; from I. G. Farben's *Erzeugnisse unserer Arbeit* (Frankfurt am Main, 1938): 15, 16, 24, 26, 27; from J.I.G. Grandville's *Un Autre Monde* (Paris, 1844): 5; from F. F. Runge's books, reproduced by kind permission of the Senckenbergische Bibliothek, Universität Frankfurt, Frankfurt am Main – *Zur Farben-Chemie* (Berlin, 1850): 9, and *Der Bildungstrieb der Stoffe* (Oranienberg, 1855): 1, 2, 3, 4, 7, 8, 10, 11, 12; from Karl Scheffler, *Deutsches Land in 111 Flugaufnahmen* (Königstein im Taunus/Leipzig, 1933): 25.

All quotations from poems by J. H. Prynne are from the collected *Poems* (Fremantle Arts Centre Press, Fremantle/Bloodaxe Books, Tasset, 2005), © J. H. Prynne and are reprinted with permission.

Index

- Adorno, Theodor Wiesengrund 22–3
 on Auschwitz 224
 on Donald Duck 19
 on existentialism 188–90
 on nature 21–2
 Aesthetic Theory 191–2, 233
 Dialectic of Enlightenment (with Horkheimer)
 21, 183
 Negative Dialectics 18, 224
 Adorno (*née* Karplus), Gretel 115
 AEG 125, 184
 in *Gravity's Rainbow* 7–8
 aesthetics 34–5
 AGFA 117, 154, 170, 171
 agriculture 82
 alchemy 8–9
 mining and 28
 Aldington, Richard 119
 alizarin 10, 77, 118, 121
 Engels on 14, 78
 Marx on 81
 Marxists on 151–2
 ammonia 125, 145
 analysis (and synthesis) 60–61
 Andromeda 115
 Anft, Bertold 175–6
 aniline 10, 14, 51, 76, 119, 134, 175, 232, 237
 Appel, Jan 144
 Arago, François 100
 arcades 15, 96–8, 107, 113
 Arp, Hans 199
 aura 225–6
 Auschwitz 185–7, 211
 Adorno on 224
 authenticity *see* genuineness
 azo-dyes 76
 nine-hour day and 153
 Baudelaire, Charles 105–6
 Bauhaus 151, 195, 201
 Baumeister, Willi 127, 136, 137, 138, 139, 140, 193, 194,
 195, 197–9, 200–04
 Baumgarten, Alexander 35
 Bayer 10, 76–7, 117, 118–19, 125, 154, 166, 168, 171, 213,
 236
 Bayer, Herbert 151
 Beatles, The 240
 Behrens, Peter 108
 Benjamin, Walter 18, 112–17, 224, 233
 on aura 22
 on Baudelaire 104–5
 on chemical warfare 126
 on consumerism 95–9
 on Marx 114
 on money 150–51
 popular science and 176
 on utopia 249
 on white-collar workers 157–8, 162
 word magic and 25–6
 Benn, Gottfried 193
 benzene 77, 154
Berlin Express 215–16
 Bernal, J. D. 33
 Bertollet, Marcellin 240
 Bertuch, Friedrich Justi 28
 Birkenau 186, 187
 Bischof, Gustav 53
 Blanqui, Louis-Auguste 105
Blast 119–25, 127
 Bloch, Ernst 17, 149, 158, 163
 blue 51, 76, 121
 Bohr, Niels 115–16
 boron 252
 Bosch, Carl 145, 169, 170
 Böttinger, Karl August 39
 Boyle, Robert 101
 Braun, Wernher von 19, 212, 239
 Brecht, Bertolt 203
 Breker, Arno 201

- Brentano, Clemens 28, 36
 Breton, André 111–12, 197
 Breton, Jacqueline 197
 Buchenwald 211
 Buffon, Georges Louis Leclerc 29
 Bunsen, Robert Wilhelm 52
 Buret, Eugène 106
 burgers 19
 Burnham, James 216–17
 Bütefisch, Heinrich 185

 capitalism 73
 fascism and 12
 town and country 83–4
 Cardiff, Jack 239
 Carlyle, Thomas 239
 Cauty, Jim 241–2
 cell 74–5
 cellophane 177
 celluloid 117, 154
 Cézanne, Paul 124, 205
 Chadwick, Edwin 82
 chance 61–2
 chemical industry (Germany) 117
 labour unrest 145–6, 153
 Nazis and 142–3
 origins of 76–7
 post-war 213–14
 war and 125, 213
 see also AGFA, BASF, Bayer, Hoechst, IG Farben
 chemical weapons 125–6
 chemistry
 dialectics of 55
 Lukács on 152
 Marx on 81–4
 origins of 29
 women and 52–3, 70
 Chesterton, G. K. 122–3
 Chitchevlov, Ivan 245
 Clark, T. J. 224
 coal 30, 46–7
 coal-tar 8, 24, 172, 174, 175
 dyes from 10, 119
 Hofmann on 76–7
 Runge and 50–51
 Cochiu, Ernst Eduard 51, 56
 Cold War 216–17, 219, 250–51
 colonialism 10
 colour
 Kracauer on 165–6
 Marx on 86
 racism and 171–2
 subjectivity and 233–4
 colour industry (Germany) 119, 143, 155, 213
 see also IG Farben
 colour industry (Switzerland) 125
 commodity fetishism 15, 22, 93–4, 223–4, 228
 Communist Party (KPD) 144, 146, 167
 Communist Workers' Party (KAPD) 144
 concentration camps 169, 209–13
 IG Farben and 185–6
 Constructivism 193, 194, 195, 201

Counsel of the Gods 214–15
 cryogenics 218–19, 222
 Cubism 121

 Dachau 169, 185, 220
 Dada 140–41, 143, 200
 Daguerre, Louis-Jacques-Mandé 100, 105
 Daitz, Werner 142
 Dawes Plan 151
 Day-Glo 235, 240–41, 246–7, 251
 De Chirico, Giorgio 222
 death 251–3
 Debord, Guy 220–23
 decalcomania 196–7
 Degenerate Art Exhibition (1937) 194
 Descartes, René 35, 152
 dialectics
 Engels on 74
 in nature 69–70
 of human and nature 253
 diamonds 103–4, 181–2, 251–3
 Disney, Walt 18, 218, 239
 Dix, Otto 193
 Döbereiner, Johann Wolfgang 48
 Dominguez, Oscar 197
 Dominik, Hans 176
 Draper, John William 100
 dreams 112–13, 115
 Drummond, Bill 241–2
 Duchamp, Marcel 140
 Duisberg, Carl 125, 141, 142, 146, 153–5, 173
 DuPont 213, 238

 ecology 82–4
 Eddington, Arthur 116
 Edison, Thomas 106
 Eichendorff, Joseph von 28
 electricity 37–8
 Engels, Friedrich 11–12, 249
 on alizarin 78, 152
 on science 74–5
 The Communist Manifesto (with Marx) 11–12
 Ernst, Max 195
 Ernst, Paul 149
 Ettinger, Robert 219–20
 existentialism 188–90
 Expressionism 127–8

 Falun mine 26–7, 44–5
 fascism 12, 18
 Feuerbach, Ludwig 36, 73, 93, 152
 Fichte, Johann Gottlieb 34, 36, 71
 Fizeau, Armand 100
 fluorescence 234–7, 240–41, 247
 forced labour *see* slave labour
 Ford, Henry 155
 Foster, John Bellamy 258
 Foucault, Leon 100
 Fourier, Charles 100, 249
 Frankfurt School 249
 French Revolution 174
 Fritzsche, C. J. 51

- Futurism 119–20, 124, 249–50
- Galvani, Luigi 37
- gas warfare 126
- Gaudier-Brzeska, Henri 124
- genuineness 188–90
- geology 29
- Gerstcker, Friedrich 96
- glass 108–12, 113
- Goebbels, Heinrich 193, 194
- Goethe, Johann Wolfgang 11, 33, 36, 58–61, 68, 71, 172, 206, 207, 210
 on colour 47
 mines and 28
 on money 91–3
 Runge and 48–9
 ‘The Metamorphosis of Plants’ 68, 70
 Wilhelm Meisters Wanderjahre 30
- gold 54, 84–9, 90–91, 149–50, 189, 190, 213, 249
 Marx on 15
- Grting, Hermann 137, 167, 185
- Gorky, Maxim 151
- Goya, Francesco Jos de 205
- Grandville 102
- Gray, Christopher 224, 232
- Greenberg, Clement 200
- Greiling, Walter 173–4
- Grimm brothers 27–8, 86
 ‘The Three Miners of Kuttentberg’ 45–6
- Gropius, Walter 108, 113
- Grosz, Georg 137, 140, 194
- ground rent 82
- Grune, Karl 159
- guano 9, 10, 83, 125, 176
- Gypsies 206–7
- Haber, Fritz 125–6, 150, 169
- Hardenberg, Friedrich von *see* Novalis
- Hartlaub, G. F. 151
- Hausmann, Raoul 140
- Heartfield, John 137, 140
- Hegel, Georg Wilhelm Friedrich 36, 222
 on natural history 44
 philosophy of nature 74
 on Schelling 35–6, 43–4
 Phenomenology of Spirit 90
- Heidegger, Martin 188
- Herberts, Kurt 195, 198, 202, 206, 212
- Herder, Johann Gottfried 39
- heroin 118
- Herschel, F. W. 36
- Herschel, William 103, 115
- Herzfelde, Wieland 143
- Hindenburg, Paul von 155
- Hitler, Adolf 137, 167, 169, 214
 on art 192, 194, 198–200, 202
- Hoch, Hannah 140, 194–5
- Hoechst 10, 76, 79, 80, 117, 118, 142, 146, 153, 236
- Hoffmann, E.T.A. 45
- Hoffmann, Heinrich 200
- Hofmann, August Wilhelm von 51, 75–6, 82, 173–4
- Holderlin, Friedrich 36
- Holz, Max 144–5
- Home, Stewart 246
- Hoover, J. Edgar 218
- Horkheimer, Max
 Dialectic of Enlightenment (with Adorno) 183
 ‘The Jews and Europe’ 12
- Hugnet, Georges 197
- Hume, David 78
- Hutton, James 30, 41
- Ibsen, Henrik 189
- ICI 213
- IG Farben 10, 47, 135, 142, 153, 166, 176, 240, 250
 Auschwitz and 12, 186–7
 dissolution of 236
 formation of 16, 153–4
 in *Gravity’s Rainbow* 7–9
 ideology of 170–73
 Leverkusen factory 167, 168
 Nazis and 155–6, 167, 169–70, 184
 poison gas and 126, 186
 post-war 19, 213–16
 war and 184–5
- Impressionism 119–20, 123, 205
- indanthrene 118, 134, 172, 176
- indigo 49, 76, 78
- individualism 189
- inflation 149–50
- infra-red 36
- Jean Paul 26, 27
- Jean, Marcel 197
- Jung, Franz 143, 147–8, 151
 The Conquest of the Machines 16
- Jung, Karl 114
- Jnger, Ernst 12, 126–7, 183
- Kammmler, Hans 211
- Kant, Immanuel 36, 78, 191
- Kapp Putsch (March 1920) 145
- Kekul von Stardonitz, Friedrich 77, 82
- Kerner, Justinus 66–7, 199
- Kesey, Ken 239
- Khayati, Mustapha 223
- Kierkegaard, Soren 189
- Kirchner, Ernst Ludwig 193
- kitsch 191–2, 200, 201
- klecksography 196, 199
- Klee, Paul 197
- Kleist, Heinrich von 39
- Kokoschka, Oskar 127, 193
- Kllwitz, Kthe 193
- Kracauer, Siegfried 16–17, 156–66
- Krauch, Carl 184, 186
- Kraus, Karl 127, 137
- Krause, Franz 198, 195, 200
- Krupp’s 184
- La Mettrie, Julien Offray de 152
- Lang, Fritz 160, 208
- Lavoisier, Antoine-Laurent 47, 55
- Law, John 89

- Le Corbusier 108, 113
 Lenin, V. I. 144, 150
 on alizarin 151–2
 mummification of 183
 Lerebours, Noël Paymal 100
 Lewis, Percy Wyndham 119–25, 127, 240
 on Germany 124–5
 Ley, Willi 239
 Liebig, Justus von 52, 75, 76, 82–3, 176
 Liebknecht, Karl 144
 Locke, John 88
 Loos, Adolf 127, 137
 Louis XIV 89
 Luckiesh, Matthew 163
 Lukács, Georg 149
 on alizarin 152
 Luxemburg, Rosa 144

 madder root 76, 77, 172–3
 Maetzig, Kurt 214
 magenta 76
 magic 9, 25–6
 Manet, Edouard 124
 Mao Tse-tung 220
 Marcet, Jane 52
 Marshall Plan 217
 Marx, Karl 11–12, 71–5, 79, 152, 228, 249
 on commodities 15, 75
 on fashion 80
 Faust and 91–2
 on gold 85–9
 on history 73
 on human senses 71–2
 on materialism 71, 72
 on money 88, 90–91, 92, 242
 versus structuralism 85, 86
 on theft 30–31
 Capital 93–4
 The Communist Manifesto (with Engels) 11–12
 A Contribution to a Critique of Political Economy 85–7
 Economic and Philosophical Manuscripts 71, 91–2
 The Eighteenth Brumaire 12
 Grundrisse 86
 The Holy Family (with Engels) 71
 mauve 8, 175
 Mendelsohn, Erich 160–61
 Mengele, Josef 185
 metamorphosis 207
 Meyer, Adolf 108
 microscope 74–5
 mimesis 191
 mining 26–7
 mirrors 98–9
 modulation 198–9, 204–5, 207
 Molzahn, Johannes 195
 Monet, Claude 205
 money 58, 73
 banknotes 150–51
 Marx on 88, 90–91, 92, 242
 paper money 88–93, 149
 Morgenstern, Christian 199

 morphology 58–9
 Moss, Frank 163
 Muche, Georg 195
 Müller, Adam 39
 myth 9

 national socialism 142–3, 146–7
 see also Nazis
 natural history 28–30, 74, 66
 nature
 Adorno on 183
 Goethe on 206
 Kracauer on 159–60
 Lewis on 123–4
 Nazis and 17, 183–4, 191–2
 Nazis 7, 167, 220, 250
 art and 192–5
 chemical industry and 142–3
 ideology of 154–5, 191–2
 nature and 17, 183–4, 191–2
 Nazi art 199–200
 Volk concept 187–8
 see also Hitler; Goebbels; Göring
 Neptunism 29, 44
 Neuburger, Benno 203–4
 New Objectivity 151
 Newton, Isaac 35, 58, 88
 Nicholson-Smith, Donald 224
 Nietzsche, Friedrich 189
 Nissen, Olaf 178
 Nolde, Emil 193
 Noske, Gustav 144
 Novalis (Friedrich von Hardenberg) 26, 27, 30, 31–4,
 36, 37, 71, 207, 221
 on nature as design 39
 Heinrich von Ofterdingen 31–2, 38–9

 Oberth, Herman 209
 oil 10, 17
 Oken, Lorenz 49
 Olympic Games 200
 Osmond, Humphrey 238
 oxygen 55

 patina 198–9, 205–7
 Patterson, Ian 232
 Pechstein, Max 193
 Pepper, Claude 214
 Perkin, William Henry 8, 76, 175
 Petty, William 87
 photography 15–16
 astral 99–100, 104–5
 Herschel and 37
 photomontage 128, 137
 Picasso, Pablo 140
 plastics 10, 14, 236–7
 Poe, Edgar Allen 97–9
 Poelzig, Hans 156, 160, 170, 190, 214
 poetics 223, 230
 polarity 35–7, 40
 polystyrene 240
 popular science 28–9, 52–3, 175–6

- chemistry sets 234
- postcards 127–8, 137, 200
- Pound, Ezra 122
- proletariat 152–3
- Proudhon, Pierre Joseph 85
- Prynne, J. H. 226–33, 251
- psychedelia 238–9
- Punk Rock 239–41, 251
- Pynchon, Thomas 7, 17
- Radcliffe, Charles 224
- Rasch, Heinz 195, 198–200
- Rathenau, Walter 125
 - in *Gravity's Rainbow* 7–8
- Reagan, Ronald 218
- recording 10
- red 173
- Reich, Wilhelm 222
- Reichenbach, Karl Freiherr von 51, 68
- Reichert, Jakob 142
- Reid, Jamie 241
- Rembrandt van Rijn, Harmenszoon 205
- Renoir, Pierre Auguste 205
- revolution 100–01, 250
 - November 1918 141–2, 143–5
 - January 1919 144
 - March Action 1921 143, 144, 146, 147
 - insurrections of 1923 146
- riots 223, 228
- Ritter, Johann Wilhelm 36, 37–8
- Roberts, William 123
- rockets 9, 208–12, 239
- Romanticism
 - dialectics of 33–5
 - network of 36
 - Surrealism and 112
- rubber 169–70, 176
- rubbish 243, 251
- Rumney, Ralph 232
- Runge, Friedlieb Ferdinand 13–14, 18, 42, 47, 48–70,
 - 75, 83, 207, 248, 250
 - dropper images 56–8, 61–8, 129–33, 199
 - Goethe and 48–9, 60–70
 - Hegel and 49–50
 - Nazi interpretation of 175–6
 - Schlemmer and 198
 - Der Bildungstrieb der Stoffe* 58, 61–7
- Runge, Philipp Otto 11, 17, 207
- Rutherford, Lewis 100
- Sand, George 197
- Sasuly, Richard 213–14
- Schacht, Hjalmar 167, 214
- Scheerbart, Paul 16, 108–11, 113, 116, 249
- Schelling, Friedrich Joseph von 36, 39, 71, 191
 - Ideas for a Philosophy of Nature* 35–6
- Schenzinger, Karl Aloys 175, 215
- Schiller, Friedrich 36
- Schlegel, August 36, 71
- Schlegel, Caroline 37
- Schlegel, Friedrich 36
- Schlemmer, Oskar 193–6, 198, 200
- Schmidt, Robert Emanuel 118
- Schmitz, Hermann 184, 214
- Schnitzler, Georg von 167, 184
- Schönbein, Christian Friedrich 82
- Schopenhauer, Arnold 207
- Schubert, Gotthilf Heinrich von 39–41, 44
- Schulze, Johann Heinrich 99
- Schwitters, Kurt 246
- science 11, 152–3
- Severinus, Petrus 28
- Sex Pistols 241
- Shapley, Harlow 116
- Shell 213
- Shelley, Mary, *Frankenstein* 37
- Simon, Pierre Henri 221
- Sinclair, Iain 243–6, 251
- Sinclair, Upton 151
- Situationists 220–23, 232, 251
- slave labour 19, 125, 209–12, 236, 250
- Spartakus-Bund 143–4
- Standard Oil 154, 213, 214
- stars 104–7, 114, 115–16, 249
- steel 7–8
- Steffens, Heinrich 71
- Steininger, Johann 71
- Stephan, Heinrich von 128
- strikes 141, 144
- Structuralism 222
- substitutes 125
- substitution 10, 11, 125, 250
 - ersatz 178–82
- Sudetenland 184
- Surrealism 112, 197
- Switzer, Robert and Joseph 234–5, 239
- Tanguy, Yves 197
- Taut, Bruno 111, 113
- Taylor, Ann and Jane 103, 106
- teeth 237–8
- television 222
- The Communist Manifesto* 11–12
- theory 59–60
- Third Reich *see* Nazis
- Tieck, Ludwig 27, 36
- time 9–10, 95–6, 237
 - Debord on 221
 - images and 63
 - Nazi aesthetics and 199–200
 - patina and 206
 - photography and 99
- Toulouse-Lautrec, Henri de 205
- Tourneur, Jacques 215
- Tupperware 237
- Turner, J.M.W. 205
- ‘Twinkle Twinkle Little Star’ 103–4, 106
- ultra-violet 36–7, 234
- Unverdorben, Otto 51
- Uranus 103
- utopia
 - Benjamin on 100–01, 249
 - Debord on 224

v-1, v-2 *see* rockets
 Van Gogh, Vincent 124, 205
 Vaneigem, Raoul 222
 varnish 195–6
 Versailles Treaty 141, 146, 154, 209
 Verschuer, Otmar Freiherr von 185
 Vicious, Sid 19
 Vistra 176–7
 Vogel, Marcel 235
 Vorticism 119–25, 249–50
 Vulcanism 29–30, 44

 Wagener, Samuel Christoph 43
 Wagner, Richard 188–9
 Wedgwood, Thomas 99
 Wehrenalp, E. Barth von 172–3
 Werner, Abraham Gottlob 29, 30, 39, 44, 71
 Werner, Friedrich Ludwig Zacharias 27
 Wolfe, Tom 239
 World War I 125–8, 250
 Wühler, Friedrich 52

 X-Ray Spex 240, 242–3

 Ziegler, Adolf 201–2
 Zinoviev, Grigory Yevseyevich 144
 Zoline, Pamela 238
 Zyklon B 186, 236